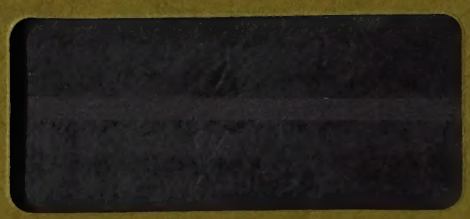
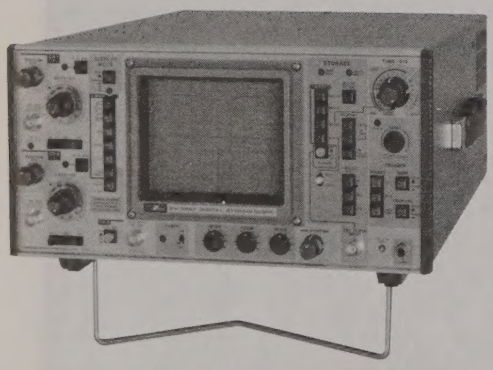
INSTRUCTION MANUAL

MP MASTER
MA31654

IWATSU®





INSTRUCTION MANUAL

DIGITAL STORAGESCOPE

SS-5802

A1-416500(I)

IWATSU ELECTRIC CO., LTD.

Main Office: 7-41, 1-chome Kugayama Suginami-ku, Tokyo 168 Japan,
Telephone Tokyo (334) 1111

Overseas Operation Department: Asahiseimei-Building 1-3, 2-chome Nihonbashi Chuo-ku,
Tokyo, 103 Japan, Telephone Tokyo (272) 0461. Telex J24225
(TELEIWA). Cable Address TELEPHIWATSU.

TABLE OF CONTENTS

SECTION 1 SPECIFICATIONS 1-1
GENERAL. 1-1
SPECIFICATIONS 1-1
CRT 1-1
Vertical Deflection System 1-1
Triggering 1-3
Horizontal Deflection System 1-3
Storage 1-3
A/D Converter 1-4
X-Y Operation 1-4
External Intensity Modulation 1-4
Signal Output 1-5
GP-IB Interface. 1-5
Power Supply 1-6
Physical Characteristics. 1-6
Environmental Characteristics 1-6
ACCESSORIES. 1-6

SECTION 2 OPERATING INFORMATION 2-1
OPERATING PRECAUTIONS. 2-1
HOW TO USE THE STAND 2-2
CONTROLS AND SWITCHES. 2-2
Front Panel 2-2
Rear Panel 2-7
OPERATING INSTRUCTIONS 2-8
Basic Operation for Use as Oscilloscope 2-8
Applying Signal. 2-8
Signal Input Coupling Selection 2-9
Vertical Deflection Factor Setting 2-9
Triggering 2-9
Sweep Rate Setting 2-12
Basic Operation for Use as Storagescope 2-13
Write Deflection Factor Setting 2-16
–(minus) DELAY Setting. 2-16
WATCH Operation 2-17
Locking Written Signals 2-17
Write Channel and Memory Length. 2-18
Reading Out to Pen Recorder 2-18
Observing Realtime Waveform and Storage Wave form 2-18
APPLIED OPERATIONS FOR SIGNAL OBSERVATION 2-18
Operation for Dual-Trace Observation 2-18
Operation for Triple-Trace Observation 2-19
Operation for Observation of the Sum of Two Signals or their Difference 2-19
Operation for Enlarging Waveforms on Screen. . 2-19
Operation for Use as X-Y Scope 2-20

SECTION 3 MEASURING PROCEDURES 3-1
ADJUSTMENT NECESSARY BEFORE MEASUREMENTS 3-1
MEASURING PROCEDURES. 3-1
Voltage Measurement. 3-1
Time Measurement 3-2
Frequency Measurement. 3-4
Phase Differance Measurement. 3-4
Measuring the Signals Written in Memory. 3-5

Specifications

GENERAL

The SS-5802 is a unique digital storage scope that combines a waveform memory and an oscilloscope into one. The waveform memory has a length of 8 bits x2048 words (or 8 bitsx 4096 words in case of CH 1 4 kW) and a maximum write speed of 1 μ sec per word; stores single and repeated electrical phenomena, and electóronic signals for optical, mechanical machine vibration, chemical variation, temperature variation, and other phenomena which have been converted by various kinds of transducers in semiconductor memories; reads them to a cathode ray tube, external pen recorder or the like for measurement. The oscilloscope has a frequency range of DC to 10 MHz, and permits 3-channel observation through electronic switching. The main features of the SS-5802 are as follows:

- In addition to 3-channel observation as an oscilloscope, the SS-5802 can be used for measuring the sum of two signals in the ADD mode and also their difference by CH 2 POLAR. CH 1 and CH 2 have a high input deflection factor of 1 mV/div.
- In 3-channel observation during storage operation, realtime waveforms for CH 1 and CH 2 and signals for CH 2 can be written in the memory, and display on the CRT screen for simultaneous comparison and observation.
- The signal waveforms displayed on the CRT screen are stored in the memory as they are. The greatly facilitates adaptation to the levels of input signals and the dynamic range of an A/D converter, which is difficult for conventional digital memories, and deflection factor adjustment. Deflection fuctor calculation is no longer necessary.
  Trigger operation is easy. The SS-5802 also has a minus delay function so that signals prior to the generation of trigger pulses can be stored in the memory and observed, which is impossible with an oscilloscope alone.
- The SS-5802 has a GP-IB interface as a standard equipment for controlling itself from the outside or executing data transfer by commands from the GP-IB interface.
- The waveforms stored in the memory can be read out to an external pen recorder for recording.
- The cathode-ray tube is a 6-inch, high-brightness, rectangular tube with an internal graticule of parallax-free type, and has a display area of 8 div high and 10 div wide (1 div = 10 mm).
- The SS-5802 also has a 10x magnifier for enlarged observation of signals, and an X-Y scope function.

SPECIFICATIONS

Cathode-Ray Tube (CRT)

Shape	Rectangupar
Display Area	8 divx 10 div (1 div = 10 mm) With internal illuminated graticule of Parallax-free type
Phosphor	B31 (Standard)
Accelerating Voltage	Approximately 10 kV

Vertical Deflection System

Display Modes	REAL, STORAGE
Vertical Modes	CH 1, CH 2, ALT, CHOP, ADD, X-Y, TRI, (Real) • CHOP repetition frequency 500 kHz ±1% • TRI in the STORAGE mode, CH 1 and CH 2 realtime and storaged CH 2 signal are displayed.

Channels 1 and 2

Deflection Factor
5 mV/div to 10 V/div, 1-2-5 sequence in 11 calibrated steps
Accuracy: ± 3% (at 10° C to 35° C)
± 5% (at 0° C to 40° C)
5 mV/div to 25 V/div, continuously variable with the VARIABLE control
5 MAG: 1 mV/div to 2 V/div, 1-2-5 sequence in 11 calibrated steps
Accuracy: ± 5% (at 10 °C to 35° C)
± 7% (at 0 °C to 40° C)
1 mV/div to 5 V/div, continuously variable with the VARIABLE control

Frequency Response
DC to 10 MHz, –3 dB
(5 mV/div to 2 V/div)
DC to 2 MHz, –3 dB
(1 mV/div)
Note:
- 10° C to 35° C
- Lower frequency limit for AC coupling is 4 Hz.

Rise time
35 nsec or less
(at 10 °C to 35 °C)

Pulse Response
Overshoot: 6%
Sag (at 1 kHz): 2%
Other distortions: 6%
(5 mV/div, 10 °C to 35° C)

Input Coupling
AC – GND – DC

Input RC
Direct:
1 MΩ±2%//34 pF ±2 pF
With probe:
(Attenuation ratio: 10 to 1)
10 MΩ±5%//23 pF ±2 pF
(Attenuation ratio: 1 to 1)
1 MΩ±3%//190 pF ±10 pF

Maximum Input Voltage
Direct:
250 V(DC +peak AC)
With probe:
(Attenuation ratio 10 to 1)
600 V(DC +peak AC)

Drift
POWER is turned ON
(Standard) (1 mV/div)

Common-Mode Rejection Ratio
In the ADD mode (5 mV/div)
30 : 1(1 kHz sine wave)
20 : 1 (5 MHz sine wave)

Polarity Inversion:
CH 2 only available

Channel 3

Deflection Factor
0.1 V/div
Accuracy: ± 3% (at 10° C to 35 °C)
± 5% (at 0° C to 40° C)

Frequency Response
DC to 10 MHz, –3 dB
Note:
- 10° C to 35 °C
- Lower frequency limit for AC coupling is 4 Hz.

Pulse Response
Overshoot: 7%
Sag (at 1 kHz): 2%
Other distortions: 7%
(at 10° C to 35 °C)

Input Coupling
AC, DC

Input RC
Direct:
1 MΩ±2%//34 pF ±2 pF
With probe:
(Attenuation ratio: 10 to 1)
10 MΩ±5%//23 pF ± 2 pF
(Attenuation ratio: 1 to 1)
1 MΩ±3%//190 pF±10 pF

Maximum Input Voltage
Direct:
250 V(DC +peak AC)
With probe:
(Attenuation ratio 10 to 1)
600 V(DC +peak AC)

Triggering

Signal Sources	CH 1, CH 2, CH 3 External triggering function sets the SOURCE to CH 3 (DC), and apply a trigger signal to CH 3, INPUT
Coupling	AC: CH 1, CH2 AC, DC: CH 3 (to be selected by coupling switch) HF REJ: CH 1, CH 2, CH 3
Slope	Positive (+), negative (−)
Minumum Trigger Sensitivity	As shown in Table 1-1

Table 1-1

(10°C to 35°C)

Frequency Range	Coupling	Channel	Sensitivity
10 Hz to 1 MHz	AC	CH 1, 2, 3	0.5 div
1 MHz to 10 MHz			1.5 div
DC to 1 MHz	DC	CH 3	0.5 div
1 MHz to 10 MHz			1.5 div

Note:

- Trigger signals are filtered as follows depending on coupling.
  - AC: Attenuated under 30 Hz
  - HF REJ: Attenuated over about 10 kHz
- Lower frequency limit in the AUTO mode is 50 Hz.

Horizontal Deflection System

Sweep Modes	AUTO, NORM
Sweep Rate	0.5 μsec/div to 0.2 sec/div, 1-2-5 sequence in 18 calibrated steps 0.5 μ sec/div to 0.5 sec/div, countinuously variable with the VARIABLE control Two ranges of 5 sec/div and 10 sec/div are for the storage only. Accuracy I (Over center 8 divisions) 0.5 μ sec/div to 50 msec/div ± 4% (at 10° C to 35° C) 0.1 sec/div to 10 sec/div ± 5% (at 10° C to 35° C) 0.5 μsec/div to 0.2 sec/div ± 6% (at 0° C to 45° C) Accuracy II (Over any 2 of the center 8 divisions) ± 5% (at 10°C to 35°C)
Sweep Magnification	10 times Accuracy I (Over center 8 divisions) 0.5 μsec/div to 50 msec/div ± 6% (at 10° C to 35° C) 0.1 sec/div to 0.2 sec/div ±7% (at 10° C to 35° C) (Except 300 nsec before and after sweep in all cases) Accuracy II (Over any 2 of the center 8 divisions) 0.5 μsec/div to 10 sec/div ±15% (at 10° C to 35° C) (Except 300 nsec before and after sweep in all cases)

Storage

Modes	SINGLE, REPEAT, WATCH, PEN
Memory Length	CH 1, CH 2: 8 bitsx 2048 words CH1 4 kW: 8 bitsx 4096 words
Display on CRT	CH 1, CH 2: 200 words/div (0.2 msec/div to 10 sec/div) CH 1, CH 2: 100 words/div (0.1 msec/div) CH 1 4 kW: 400 words/div (0.5 msec/div to 10 sec/div)
Writing Speed	CH 1, CH 2: 0.1 msec/div (0.1 msec/100 words) 0.2 msec/div (0.2 msec/200 words) to 10 sec/div (10 sec/200 words)

	CH 1 4 kW: 0.5 msec/div (0.5 msec/400 words) to 10 sec/div (10 sec/400 words) Note: In case of 4 kW, density is doubled so speed is one half of that indicated by the set time division.
Maximum write speed	1 μ sec/word
Reading Speed	
SINGLE	Same as writing speed
REPEAT	Same as writing speed
WATCH	Read clock — 5 μsec/word (Read while writing by write clocks in 4 ranges of 0.1 sec/div, 0.2 sec/div, 5 sec/div, and 10 sec/div)
PEN	25 msec/word (5 sec/div range) 50 msec/word (10 sec/div range)
EXT CLOCK	Pulse with a TTL level of under 1 MHz Width of pulse driven by plus (+) edge High level: 500 nsec or more Low level: 500 nsec or more Rise time: 500 nsec or less Maximum input Voltage: +20 V (AC + peak AC) Input resistor: 4 kΩ±200Ω
Delay	—(minus) delay only (Phonomena prior to the generation of trigger pulse is also written)
Amount of Delay	0, 2.5 div, 7.5 div 0.2 msec/div to 10 sec/div (200 words/div) 0.1 msec/div (100 words/div)
Memory	CH 1, CH 2 LOCK Data stored in either CH 1 or CH 2 is held. If CH 1 4 kW is used, CH 2 is unlocked.
	CH 1 4 kW: Only CH 1 has a memory length of 4096 words.
Storge Quality	5 mV/div to 10 V/div(where x 5 MAG is out)

A/D Converter

Resolution	8 bits, 0.4% (at full scale)
Conversion	Successive approximation A/D conversion
Maximum conversion speed	1 μ sec/word
Scale-over	Beyond 8 div on vertical scale
Bandwidth	DC to 250 kHz, —3 dB
Gain difference between realtime and storage	±3%

X — Y Operation

Input	X axis: CH 2 Y axis: CH 1
X Axis	
Deflection Factor	5 mV to 10 V on VOLTS/DIV 1-2-5 sequence in 11 calibrated steps Accuracy: ±5% (at 10°C to 35°C)
Frequency Response	DC to 500 kHz, —3 dB
Input RC	Same as that of CH 2
Maximum Input Voltage	Same as that of CH 2
Y Axis	Same as X axis
X—Y Phase Defference:	3° or less (DC to 20 kHz)

External Intensity Modulation

Input voltage	3 Vp-p
Polarity	Positive (dark), negative (bright)
Frequency Range	DC to 1 MHz
Input Resistance	20 k Ω ±10%
Maximum Input Voltage	50 V (DC + peak AC)

Signal Outputs

D/A CH 1, CH 2 OUT

Output Waveform	Data written in CH 1, CH 2 Memories
Output Voltage	+2.0 V, –2.015 V, ±40 mV (full scale level)
Output Resistance	Approximately 800 Ω

SWEEP OUT

Output Waveform	Sawtooth
Output Voltage	5 V or more
Output Level	±0.5 V
Output Resistance	Approximately 1 kΩ

GATE OUT

Output Waveform	Negative pulse synchronized with sawtooth
Output Voltage	2.5 Vp-p or more
Offset Voltage	–0.5 V ±0.6 V
Output Resistance	1 kΩ

PEN UP

Output Waveform	Square wave of a length corresponding to one data written in the memory
Output Level	TTL level
Polarity	Positive
Output Resistance	1 kΩ ±20%

Calibrator

Output Waveform	Square wave
Repetition Frequency	1 kHz Accuracy: ±30% (at 0°C to 40°C)
Duty Ratio	40% to 60%
Output Voltage	0.3 V Accuracy: ±3% (at 10°C to 35°C)

GP-IB Interface

Memory data transfer	
Read	All data, section data, one word
Write	All data, section data, one word Either ASCII or binary format may be used.
Operation	Write/read operation stop; analog signal write; read start; write trigger generation
Panel Setting	Clock rate, selection; Channel selection; Clock source selection
Panel Status Read	Clock rate, Channel selection, clock source selection, input range, storagescope operating status
Input/Output Signals	TTL open collector output, active low TTL input, active low
No. of Units Connectable	15 maximum per system
Cable Length	20 m maximum per system (No. of units connected x 2 m or less)
Input/Output Connectors	24-pin GP-IB connectors (DDK 57-20240-D35)

The electrical and physical specifications fit the IEEE Std. 488-1978.

Table 1-2 Pin Numbers and Signals

Symbol	Interface Function	Description
SH 1	Source Handshake	Complete capability
AH 1	Acceptor Handshake	Camplete capability
T 6	Talker	Basic talker, serial poll, Unaddress if MLA
L 4	Listner	Basic Listner, Unaddress if MTA
SR 1	Service Request	Complete capability
RL 0	Remote Local	No capability
PP 0	Parallel Poll	No capability
DC 1	Device Clear	Complete capability
DT 0	Device Trigger	No capability
C 0	Controller	No capability

Power Supply

Voltage Range	Standard; 100 V (90 to 110 V)/ 117 V (106 to 128 V)/ 210 V (198 to 242 V)/ 234 V (211 to 257 V)AC Option: 110 V (99 to 121 V) / 200 V (180 to 220 V) AC
Frequency Range	50 to 400 Hz
Power Consumption	Approximately 74 W

Physical Characteristics

Weight	Approximately 11.3kg
Dimensions	320 ±2 (W) x 160 ±2 (H) x 470 ±2 (L) (mm) See figure 1-1.

Enviromental Characteristics

Ambient condition

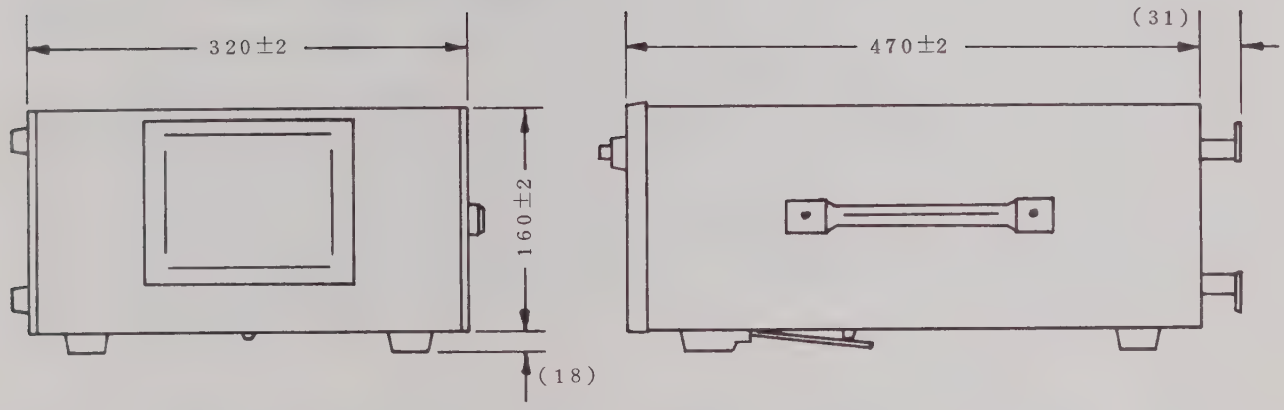
Operating temperature	0°C to 40°C
Operating humidity	40°C, 90% R.H.
Storage temperature	−20°C to +70°C
Strage humidity	70°C, 80% R.H.

Altitude	Operating: 5000 m maximum (atmospheric pressure 428 mmHg) Non-operating: 15,000 m maximum (atmospheric pressure 87 mmHg)
Vibration	From 10 Hz to 55 Hz and back in 1 minute; double amplitude 0.63 mm; for 15 minutes each in vertical, horizontal, and longitudinal directions for a total of 45 minutes
Impact	One side is raised 5 cm up (to a maximum elevation of 30°), and let fall on a piece of hard wood. Each side is put to this test 3 times or more.
Drop	A package ready for transportation is dropped from a height of 75 cm.

ACCESSORIES

Probe (1036)	2 PCS
Fuse	2
Power cord (3-core)	1
Instruction Manual	1
Dust cover	1
Accessories bag	1

Figure 1-1 Dimensional Diagram



Notes

Operating Information

OPERATING PRECAUTIONS

Observe the following precautions in operating the SS-5802.

Ambient Temperature and Air Ventilation

The ambient temperature range of this instrument for showing normal operation is from −10 °C to + 50 °C. The Use of this instrument with the temperature exceeding this range may cause trouble; therefore the operation in this range must be always required. Do not place other devices or apparatus close to this instrument in order to improve the efficiency of heat radiation.

Check of Line Voltage

Desired operating voltage can be selected from four voltage ranges shown in Table 2-1 by setting the voltage selecting plug located on the rear panel. Check the line voltage prior to the connection of the power cord and plug the selection plug so that its arrow mark can be lined with a voltage range indication on the panel which covers the line voltage. Note that connecting this instrument to a voltage source which is not covered by the voltage selected may result it trouble of the instrument.

Before changing the voltage range, check that a fuse shown in Table 2-1 is set in the fuse holder on the rear panel.

Table 2-1

Set Position	Center Voltage	Voltage Range	Remarks	Fuse
A	100 V	90 to 110 V	Standard	1 A slow-blow
–	110 V	99 to 121 V	Option	
B	117 V	106 to 128 V	Standard	
–	200 V	180 to 220 V	Option	0.5 A slow-blow
C	217 V	198 to 242 V	Standard	
D	234 V	211 to 257 V	Standard	

Use prescrived Fuses for Exchange

This instrument uses fuses shown in Table 2-2 in order to prevent the damage of circuit due to overcurrent.

If these fuses blew, check its cause correctly, repair the wrong parts or circuits, and exchange the blown fuses with prescribed new ones. The use of new fuses which are not prescribed may cause dangerous trouble.; therefore, such use is prohibited positively.

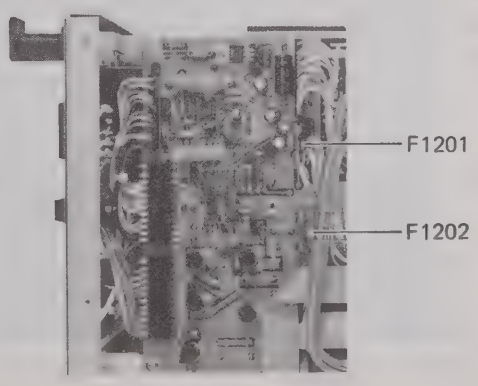
Table 2-2

Circuit No.	Fuse Spec.	Function	Position
F1203	1 A slow-blow	Line voltage selector at A or B	Rear panel
	0.5 A slow-blow	Line voltage selector at C or D	
F1202	1 A slow-blow	CRT protection	See figure 2-1.
F1201	0.25 A slow-blow	+160 V power circuit protection	

Use the supplied power cord

Use the supplied 3-core power cord.

Figure 2-1. Fuse locations



When operating the SS-5802 on the line voltage from a 2-core outlet with a conversion or adapter, be sure to ground the ground terminal on the rear panel to prevent danger.

Signal applies to the probes and input connector

Be sure to connect the probe ground leads and input connector gound terminals to the ground voltage part of the object to be measured. If they are connected to other point, the ground leads or terminals will be shorted through the SS-5802, resulting in breakage of the measuring object or the SS-5802 (including its probes). This must be absolutely avoided.

Do not apply overvoltage

The maximum input voltage that can be applied to each signal input connector is as follows. Never apply any voltage in excess of the levels specified below.

CH 1, CH 2, CH3, signal inputs:	250 V (DC + peak AC)
Input x 1 where probes are used:	250 V (DC + peak AC)
Input x 10 where probe are used:	600 V (DC + peak AC)
EXT CLOCK INPUT:	±20 V (DC + peak AC)
Z AXIS INPUT:	50 V (DC + peak AC)

Do not increase intensity excessively

Do not increase the intensity of traces or spots more than necessary. Excessive intensity can not only result in eyes fatigue but, if left for a long time, burn the CRT phosphor.

Using the SS-5802 with the CRT screen up

If the GP-IB interface is not connected to the rear panel of the SS-5802, it can be used with the CRT screen up. Be careful not to bring the SS-5802 down by pulling hard the probes connected to the signal input connector.

HOW TO USE THE STAND

A bail-type stand is mounted on the bottom cover. The stand may be pulled out as shown in figure 2-2 (b) to facilitate waveform observation. Be sure to pull the stand all the way out front.

Before taking photographs with a trace-recording camera connected to it, or storing the SS-5802, be sure to fold the stand.

CONTROLS AND SWITCHES

The functions of the switches and controls on the front and rear panels are explained. Refer to figures 2-3 and 2-4.

The front panel is color-coded. The vertical deflection factor are green. the trigger, horizontal deflection, power, and cathode-ray tube sections are dark grey; and the storage section is sky blue.

If the VARIABLE controls for vertical deflection factor and sweep rate are set to other than the CAL position, the indicator lamp lights to indicate non-calibration.

In the description of the switches, the word IN indicates their pushed-in position (▬) and the word OUT their released position (▮).

Front Panel

Vertical Axis

POSITION REAL (CH 1, CH 2)

Moves a real trace position vertically (Y axis).

STORAGE (PULL STOR) CH 1 (Y)

Push: CH 1's full scale range can be confirmed when the DISPLAY MODE button is in the STORAGE postision ( ). Trace position comes to the top of the scale when the REAL POSITION control is turned fully clockwise; or to the button of the scale when the same control is turned fully countercloskwise.

Figure 2-2. How to Use the Stand

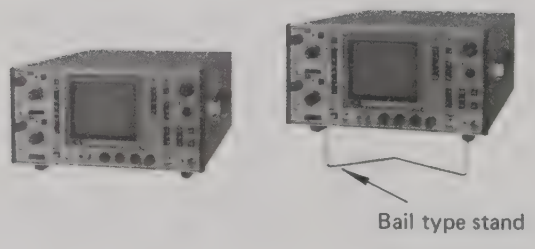


Figure 2–3. Front panel

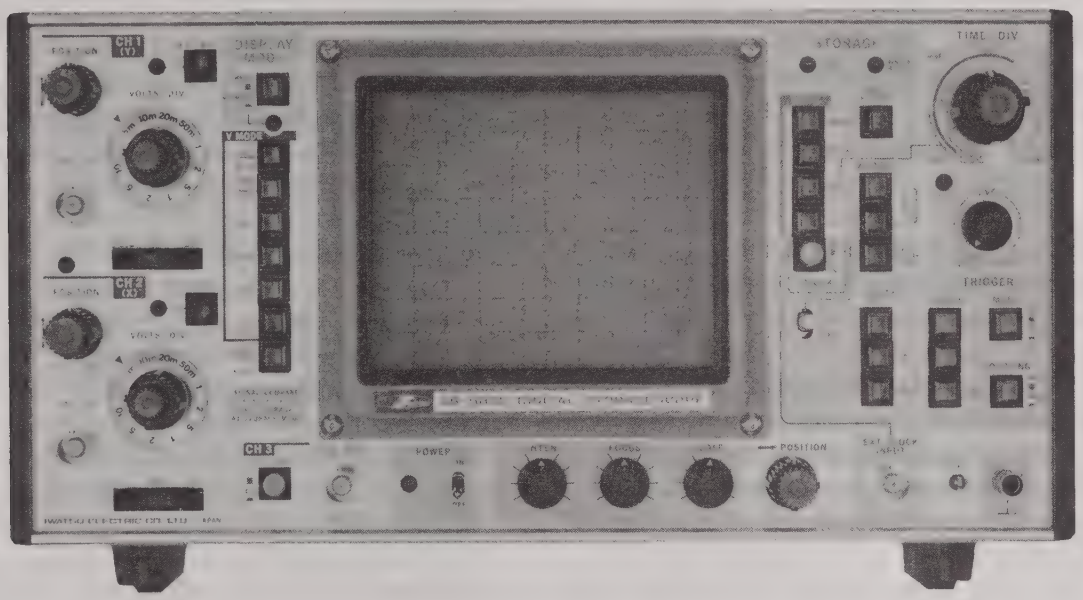
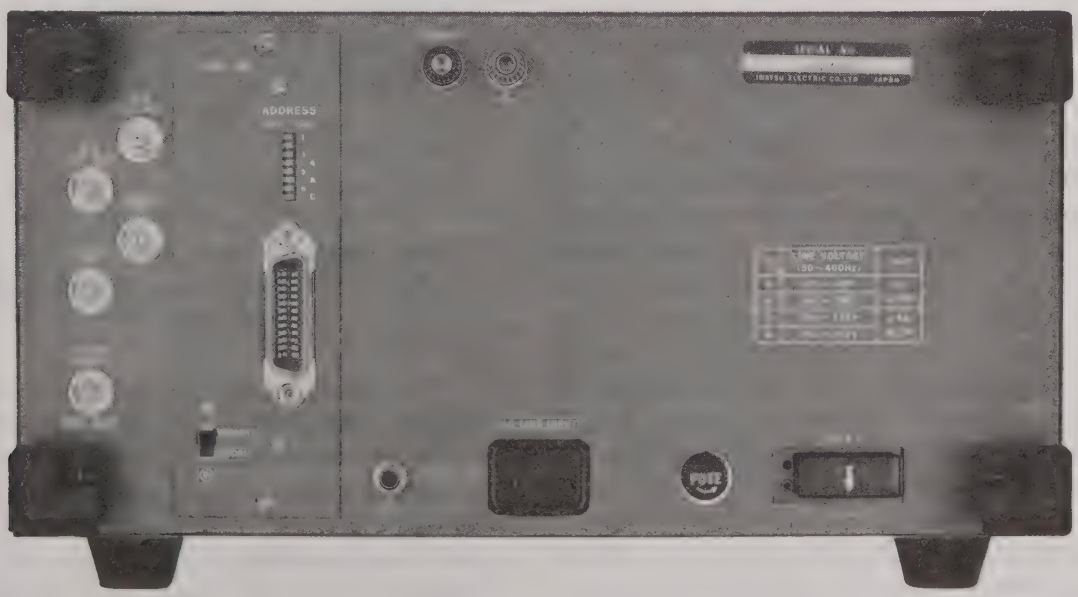


Figure 2–4. Rear panel



Pull: Moves CH 1's trace position vertically (Y axies) when the DISPLAY MODE button is in the STORAGE position.

1 MΩ 34pF (CH 1, 2, 3)

Connect the probe of accessory or coaxial cable to apply the input signal.

Maximum input voltage is 250 V (DC + peak AC).

UNCAL CH 1 OR 2

If the VARIABLE control for CH 1 or CH 2 is set to other than the CAL position, the indicator lamp lights to indicate non-calibration.

STOR OR CH 3 (PULL CH 2 STOR OR CH 3 REAL) CH 2 (X)

Push: CH 2's full scale range can be confirmed when the DISPLAY MODE button is in the STORAGE position

Trace position comes to the top of the scale when the REAL POSITION control is turned fully clockwise; or to the botton of the scale when the same control is turned fully counterclockwise.

CH 3's trace position comes to the center of the scale when the DISPLAY MODE button is in the REAL position

PULL; Moves CH 2's trace position vertically (Y axis) when the DISPLAY MODE button is in the STORAGE position

Moves CH 3's trace position vertically (Y axis) when the DISPLAY MODE button is in the REAL position

VOLTS/DIV (CH 1, CH 2)

These controls are used to change the vertical deflection factor to any of 11 positions from 5 mV/div to 10 V/div to suit input signal level. If the x5 MAG button is pushed in when either of these controls is at 5 mV/div or 10 mV/div, a high deflection factor of 1 mV/div or 2 mV/div can be obtained.

The value indicated for a VOLTS/DIV switch position represents the voltage of an input signal per div of the scale on the CRT screen where the VARIABLE control is set to the CAL position.

VARIABLE (CH 1, CH 2)

The VARIABLE controls are used to continuously attenuate the vertical deflection factor. The attenuation ratio is 2.5 times or more when the controls are turned fully counterclockwise.

The VOLTS/DIV switch range from one deflection factor position to another can be continuously adjusted with these VARIABLE contols.

IN x5 MAG (CH 1, CH 2)

If the button is pushed in, the vertical deflection factor is magnified 5 times, which is indicated by the lighting of the lamp on the left.

AC-GND-DC (CH 1, CH 2)

These switches are for selecting any of the signal input coupling modes mentioned below.

AC: This position is for AC coupling. DC components, if any, in input signals are blocked. Only AC components are allowed to pass.

DC: This position is for DC coupling. All frequency components of input signals, including DC components, are allowed to pass.

GND: Input signal is disconnected from the vertical amplifier, and the input of the vertical amplifier is grouned. Thus the ground voltage(normally serving as a reference level for measurement) can be easily confirmed.

AC-DC (CH 3)

This button is for selecting either AC or DC coupling for signal input to CH 3. Push the button in (▬) to select DC coupling, and push it again to the out position (▙) for AC coupling, (Refer to the preceding item.)

DISPLAY MODE

Select REAL or STORAGE with this button.

Push the button IN for STORAGE and push it again to the OUT position for REAL. When the DISPLAY MODE is set to the STORAGE the lamp under the button is light.

V MODE

The V MODE buttons are used for switching vertical deflection operation to select the following modes.

CH 1: Only signal which is applied to the CH 1 (Y) INPUT is displayed on the CRT screen. In X-Y operation, CH 1 serves as Y axis.

CH 2: Only signal which is applied to the CH 2 (X) INPUT is displayed on the CRT screen. In X-Y operation, CH 2

serves as X axis.

ALT: Dual-trace display of signals on CH 1 and CH 2, switched from one channel to the other at the end of each sweep.

CHOP: Dual-trace display of signals on CH 1 and CH 2, switched from one channel to the other at a repetition rate of approximately 500 kHz.

ADD: This mode is selected when both CH 1 and CH 2 buttons are simultaneously pushed in. The CRT screen displays the algebraic sum of the signals applied to CH 1 and CH 2, or their difference. CH 1 ±CH 2 can be selected with the CH 2 POLAR button.

X-Y: X-Y operation mode

TRI (REAL): This mode is for triple-trace display. If the DISPLAY MODE button is pushed in , however, the signals applied to CH 1 and CH 2 are displayed in real-time, besides the signal applied to CH 2 is also displayed in storage. Therefore, triple-trace, the signal (realtime waveforms) applied to CH 1 and CH 2 and signal (storage waveform) applied to CH 2, are observed on the CRT screen. Thus the storaged signal and realtime signals can be comparatively observed.

Note: If the WATCH button is pushed in at STORAGE operation the storaged signal and realtime signals cannot be comparatively observed.

CH 2 POLAR IN INV: The polarity of the signal applied to the CH 2 INPUT connector is inverted. In the STORAGE mode, the polarity of signal is inverted before storage.

Power, Calibrator, and CRT Controls

POWER

Power switch.

INTEN

Adjusts the brightness of traces or spot.

FOCUS

Focuses traces or spot.

SCALE

Adjusts scale illumination.

CAL 0.3 V 1 kHz

Signal output terminal of a square wave with a calibrated voltage of 0.3 V and a repetition frequency of 1 kHz.

Signal ground terminal

Horizontal Axis

TIME/DIV

Selects sweep rates in realtime display, write and read rates and read rates to a pen recorder in storage operation.

Any of 18 sweep rates from 0.5 μ sec/div to 0.2 sec/div can be selected for realtime display.

Any of 13 write and read rates from 0.1 msec/div to 10 sec/div can be selected in storage operation.

Either the 5 sec/div or 10 sec/div read rate to a pen recorder can be used in storage operation.

VARIABLE

This control can continuously lower sweep rates. Turning the control fully counterclockwise slows down by more then 2.5 times. It is used for continuously adjusting the sweep rate range from one TIME/DIV position to another.

POSITION

A coarse adjuster for the horizontal position of traces or spot.

FINE (PULL x10 MAG)

A fine adjuster for the horizontal position of traces or spot. When the control knob is pulled, waveforms are magnified 10 times.

Trigger

MODE

This button selects either of the following trigger modes.

AUTO: In the AUTO mode, a sweep is started if triggered or a free-running sweep takes place otherwise.

NORM: In the NORM mode, a sweep is started if triggered or no sweep takeplace otherwise.

LEVEL

This control is used to set a trigger level and trigger slope. Push (and turn) it for selecting a positive-going (+) slope trigger level; or pull (and turn) it for selecting a negative-going (—) slope trigger level.

TRIG

This lamp lights upon triggering.

SOURCE

The SOURCE buttons are used for selecting trigger signals.

CH 1: Applied signal to the CH 1 INPUT connector is branched out as trigger signals.

CH 2: Applied singal to the CH 2 INPUT connector is branched out as trigger signals.

CH 3 (DC): Applied signal to the Ch 3 INPUT connector is used as external trigger signals.

COUPLING

Use this button for selecting the desired coupling mode.

AC (DC): AC coupling is selected if the SOURCE CH 1 or CH 2 button (internal trigger) is pushed in.

If the SOURCE CH 3 button (external trigger) is pushed in, AC or DC coupling is selected.

In the AC coupling mode, the trigger circuit is AC-coupled, and the DC component of trigger signal is rejected. In the DC coupling mode, the trigger circuit is DC-coupled, and trigger can be effected even by DC signal. At this time, coupling of AC or DC can be selected by the AC-DC (CH 3) button of CH 3.

HF REJ: coupling by a lowpass filter rejects trigger signal frequencies over about 10 kHz.

Storage

READ BUSY

This lamp lights when data begins to be read out and goes out when data read ends.

WRITE BUSY

This lamp lights when signal is being awaited or being written in, and goes out when data write end.

WRITE READY

When this button is pushed in ( ), the instrument is ready for receiving write trigger signals. If the WRITE READY button is pushing in after pushing the SIGNAL button in ( ), the WRITE BUSY lamp lights, indicating that the instrument is ready for receiving write trigger signals. Input signal is written in the memory when a trigger signal is provided.

MODE

The MODE button are used to select modes in which to write input signal to the memory or read the stored data from the memory. These buttons are effective only when the DISPLAY MODE button is in the STORAGE position.

SINGLE: When this button is pushed in, input signal is written in the memory only once and the input data is displayed on the CRT screen.

REPEAT: When this button is pushed in, input signal is written in the memory and the input data is displayed on the CRT screen repeatedly.

WATCH: This button is used for watch operation, provided that the TIME/DIV control is at any of the four position: 0.1 sec/div, 0.2 sec/div, 5 sec/div and 10 sec/div.

PEN: When this button is pushed in, the data stored in the memory is read out on a paper of a pen recorder for recording.

SET/START

Used for reading the stored data in the memory out on a paper of a pen recorder for recording.

Turn the switch to SET position makes the instrument for set position or turn the switch to START position makes the instrument for read the storaged data.

The PEN button of the MODE must be pushed in, and the TIME/DIV switch must be at either 5 sec/div or 10 sec/div.

At the same time as the data is recorded by a pen recorder, it is displayed on the CRT screen.

Once the switch is turned down to the START position, the data continuous to be read out till the end. If the switch is directly turned down to the START position without first turning it up to the SET position, or if the switch is turning up to the SET position while the data is being read out, a single sweep takes place without data read.

CLOCK

Selects clocks. Push the CLOCK button in ( ) for external clock, and push it again to the out position ( ) for internal clock.

EXT CLOCK INPUT

External clock input connector to receive clock pulses with frequencies of under 1 MHz.

MEMORY

The MEMORY buttons are used to lock (hold) the data stored in the memory, or select a memory length of 4 k words for CH 1.

CH 1 IN LOCK: The signal stored in the memory for CH 1 is locked. This is effective where the CH 1 memory length is 4 k words.

CH 2 IN LOCK: The signal stored in the memory for CH 2 is locked.

IN CH 1 4 k WORD: Push this button in to select the 4096-word length for the CH 1 memory in writing input signal in or reading them out of the memory.

–DELAY (DIV)

Use these buttons to select –(minus) delay trigger points.

0: ZERO delay. Signal before the trigger point cannot be observed.

2.5: The signal 2.5 div before the trigger point and that 7.5 div after the trigger point can be obsetved.

7.5: The signal 7.5 div before the trigger point and that 2.5 div after the trigger point can be observed.

<CAUTION>

- **200 words/div at 0.2 msec/div to 10 sec/div 100 words/div at 0.1 msec/div.**
- **The number of words is doubled where CH 1 4 k words is selected.**
- **TRIG INHIBIT: If the WRITE READY button is pushed in, trigger signal is rejected during the time of the TIME/DIV setting multiplied by the selected –(minus) DELAY value.**

Rear Panel

D/A CH 1 OUT

Provides the input signal stored in the CH 1 memory.

D/A CH 2 OUT

Provides the input signal stored in the CH 2 memory.

SWEEP OUT

Provides a sawtooth signal synchronized with the TIME/DIV setting. Can be used to apply to the axis of X-Y recorder.

GATE OUT

Provides a negative-going pulse signal synchronized with sawtooth signals.

GP–IB

GP–IB interface card is mounted. For details, refer to the description of "GP–IB Interface" in Section 7.

ADDRESS: For setting addresses and terminators (delimita to used in data transfer.)

Multiconnector: For connecting the GP-IB input/output signal multiconnector.

REMOTE/LOCAL: Set this switch to REMOTE when remote controlling of this instrument with an external controller signals or to LOCAL when controlling it with the controls of this instrument itself.

Z AXIS INPUT

Applies a signal for external intensity modulation.

PEN UP

Pen control signal output terminal for reading the data stored in the memory out to a pen recorder for recording.

(Ground terminal for protection)

Ground terminal for protecting of this instrument. When supplying a line voltage from a 2-core electrical outlet, be sure to connect this terminal to the earth ground.

AC LINE INPUT

AC power is supplied to this connector. Connect the accessoried power cord to it.

FUSE

Fuse holder

A. B. C. D. (Voltage Selector Plug)

Set the select plug's arrow to one of the A, B, C, D positions to suit the AC line voltage. (See the LINE VOLTAGE table.)

OPERATING INSTRUCTIONS

The basic operating procedures for the instrument used as an oscilloscope or storage scope for voltage waveform observation are explained below.

Basic Operation for Use as an Oscilloscope

The following procedure applies where a 0.3 V CAL signal is applied to the signal input connector with the accessories probe for observation.

Turning POWER switch ON

Before connecting the power cord, check the AC line voltage with a voltmeter, and set the voltage selector plug to the proper position to suit the line voltage.

1. Turn the POWER switch down to the OFF position, and plug in the power cord to the AC LINE INPUT connector on the rear panel and to the elctrical outlet.
2. Set the switches and controls as follows.

DISPLAY MODE	REAL
V MODE	CH 1
VOLTS/DIV (CH 1)	5 mV
IN x5MAG (CH1)	Out
POSITION (CH 1)	Midrange
AC-GND-DC (CH 1)	DC
VARIABLE (CH 1)	CAL
TIME/DIV	5 mSEC
VARIABLE	CAL
LEVEL	Midrange
MODE	AUTO
SOURCE	CH 1
COUPLING	AC (DC)
POSITION	Midrange
REMOTE/LOCAL (Rear panel)	LOCAL

3. Turn the POWER switch to ON position,and adjust the INTEN control slowly clockwise about 15 seconds later so a trace appears on the CRT screen. Turn FOCUS control to make the trace fine and clear.

Appling Signals and Triggering

4. Using the accesories probe, connect the CH 1 signal input connector to CAL 0.3 V. Turn the tip of the probe to the x10 position.
5. Turn the LEVEL control to nearly the midrange for triggering, and a 6 div calibrated voltage waveform is displayed on the CRT screen. For a detailed description of triggering, refer to "Triggering " in a subsequent paragraph.

Applying Signals

Apply the signal to be observed to the CH 1, CH 2, and/or CH 3 INPUT connectors.

Generally, a passive probe is used to measure the signal.

The use of a probe prevents the waveform observed from being adversely affected by the induction of an external electric field. If an attenuation ratio of x10 is selected, the input RC is higher than where an attenuation ratio of x1 is selected or where no probe is used, and thus the load effect on the signal source is lessened. If the signal source generates high-impedance, high-frequency signals, select the x10 position for accurate observation.

If the x10 position is selected, however, the input signal is attenuated to 1/10 so the VOLTS/DIV readings of input signal amplitude must be multiplied by 10.

The x1 position is suitable for observing low-frequency, low-level signals because a large load effect is produced on high-frequency signals.

For a detailed description of the probe, refer to the Instruction Manual for Probe.

Signal Input Coupling Selection

Various kinds of signals, including DC, AC super imposed on DC, and AC, can be observed. For accurate observation of these kinds of signals, select the proper signal input coupling with the AC-GND-DC switch.

AC Coupling:

If an AC signal is superimposed on DC signal, the DC component is blocked by a capacitor so only the AC signal passes it. Thus, even if the deflection factor is raised, the AC signal waveform will not be moved out of the screen by the DC so it can be observed with the amplitude increased on the CRT screen.

If a signal with a low repetition frequency is observed in the AC coupling mode, a sag appears in the waveform if the signal is a square wave; or if it is a sine wave, the amplitude on the CRT screen is attenuated (about –3 dB per 4 Hz) from the actual one.

DC Coupling:

All the frequency components of input signals are allowed to pass. DC coupling is normally used except when blocking the DC components of input signals.

Gound Coupling:

The vertical amplifier input is grounded so a ground level trace is displayed on the CRT screen. The ground level serves as reference level in measurements.

Vertical Deflection Factor Setting

To observe a signal waveform, it must be displayed with an appropriate amplitude on the CRT screen. The waveform cannot be observed if its amplitude is too small, or too large beyond the dimensions of the screen. This means that the deflection factor must be increased for a signal input that has a low level, or decreased for a signal input that has a high level.

The CH 1 and CH 2 VOLTS/DIV switches are the deflection factor select switches, and their VARIABLE controls are for fine deflection factor adjustment. If the VARIABLE controls are turned fully clockwise to the CAL position, the positions of the VOLTS/DIV switches directly indicate the selected deflection factor values, which represent the voltage per division of the screen scale for the signal waveforms displayed.

The deflection factor decreases as the VARIABLE controls are turned counterclockwise. When the VARIABLE controls are turned fully counterclockwise, the attenuation ratio is more than 2.5 times the value indicated at each position of the VOLTS/DIV switches.

Triggering

Input signal waveforms cannot be obsered without triggering, and thus it is necessary to have a correct understanding of the triggering procedure, which is described as follows:

- Trigger signals
  Push in one of the SOURCE button to select CH 1, CH 2, or CH 3.
- Trigger coupling
  Select either AC (DC) or HF REJ with the COUPLING button.
- Trigger mode
  Select either AUTO or NORM with the TRIGGER MODE button.
- Polarity
  Select either positive-going (+) or negative-going (–).
- Level
  Select a trigger level with the LEVEL control.

Note: If the SOURCE CH 1 or CH 2 button is pushed in, AC coupling is selected when the COUPLING AC (DC) button is set at out position.

If the SOURCE CH 3 button is pushed in, the same coupling is selected as selected with the CH 3 INPUT (AC, DC) button.

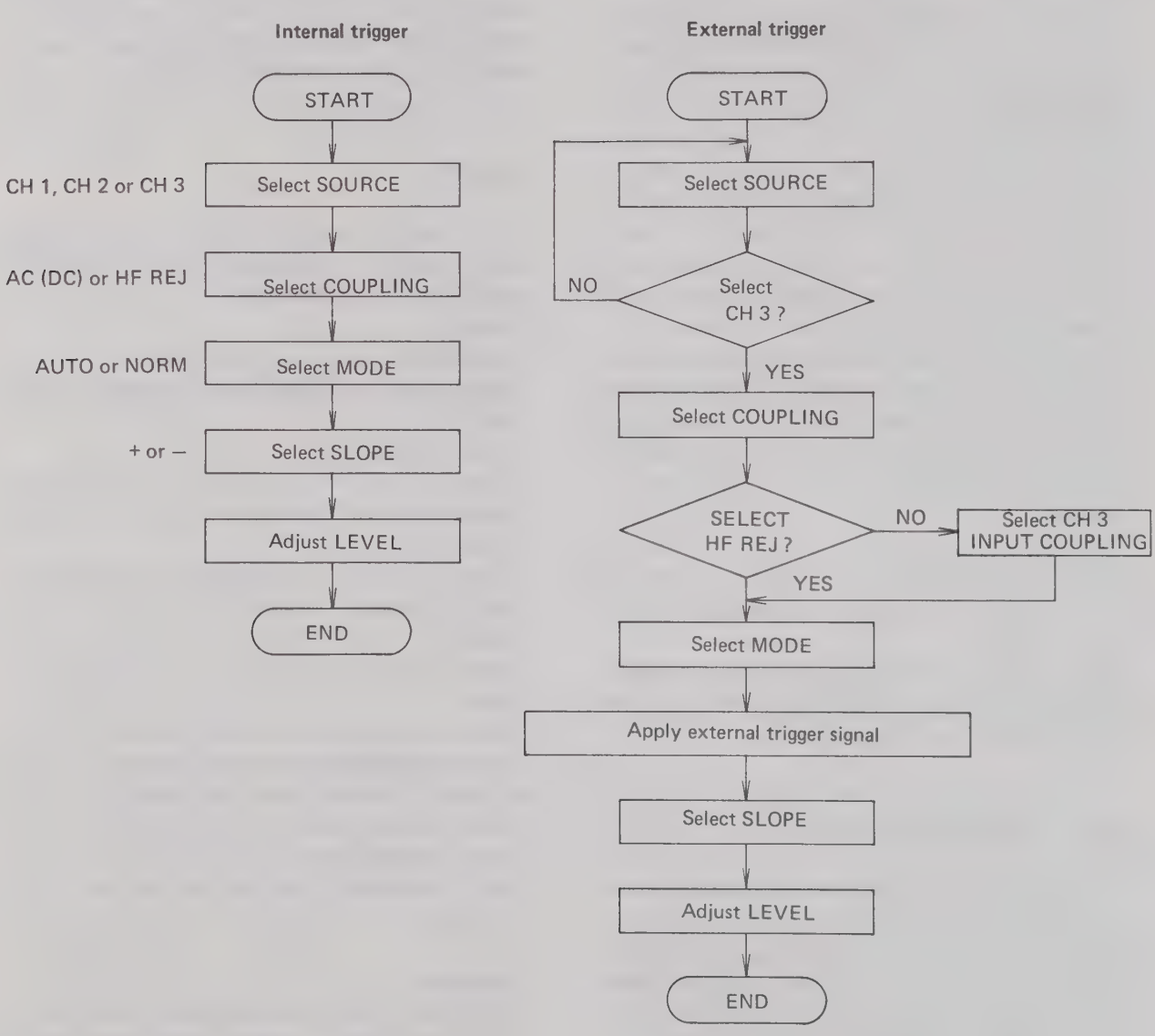
Trigger signals

To observe an input signal waveform it is necessary to apply an input signal, or a signal which has a constant time relationship with the input signal (called a trigger signal), to the trigger circuit to drive it.

Select internal trigger (CH 1, CH 2, CH 3) or external trigger(CH 3) with a SOURCE button.

The methos of branched signal to be measured that is applied to the INPUT connector from the vertical deflection and applying it to the trigger circuit is called internal trigger.

Figure 2-5. Flow chart of triggering procedure



Internal trigger is used where the signal to be measured is used as trigger signal. Thus, operation is simple.

The method of applying an external input signal, or a signal which has a constant time relationship with the input signal, to the trigger circuit is called external trigger.

External trigger has the following advantages.

- External trigger is unaffected by the channel to which an input signal is applied. In the internal trigger mode, the trigger signal amplitude changes whenever the deflection factor is changed, and thus the trigger level must be adjusted accordingly. In the external trigger mode, once trigger condition is established, the signals remain triggered even if the signal to be measured changes in amplitude unless the external trigger signal changes itself.
- If a sweep is desired a specifiec time before, or after, an input signal waveform, apply this signal as trigger to CH 3 INPUT so that the desired waveform can be observed.

Internal trigger (CH 1, CH 2, CH 3)

If the one of SOURCE button CH 1, CH 2, or CH 3 is pushed in, the input signals applied to these channels serve as trigger signal.

External trigger (CH 3)

If the SOURCE button CH 3 is pushed in, the input signal applied to CH 3 INPUT serves as external trigger signal.

Trigger coupling

The COUPLING button is used for selecting a coupling mode for the trigger circuit input.

Either AC (DC) or HF REJ may be selected as suitable to the kind of trigger signal used for steady triggering.

AC: The trigger input circuit becomes AC-coupling. So the DC component of the trigger signal is blocked. Thus, only the AC component of the trigger signal is used for triggering.

Generally, AC coupling is convenient, but triggering is difficult if the trigger frequency is below 30 Hz.

DC: The trigger input circuit becomes DC-coupling. If a trigger signal is mixed with a DC, whose voltage is outside the trigger level range, trigger is ineffective.

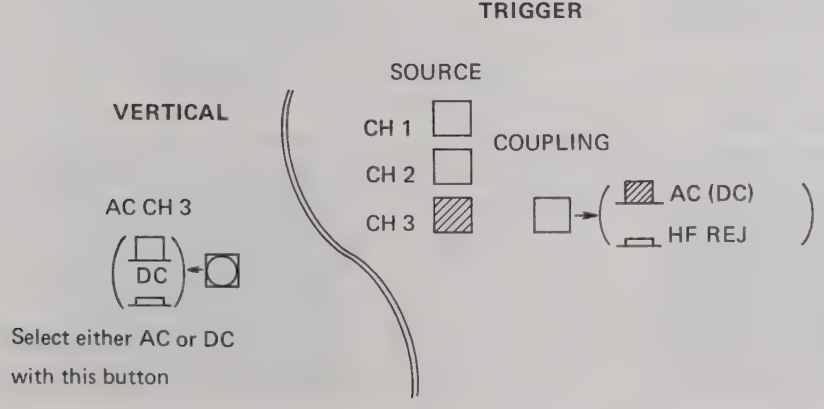
HF REJ: The trigger input circuit has a lowpass filter which rejects high-frequency triggers signals (over about 10 kHz) and high-frequency noises with high-frequency signals, and passes only low-frequency components.

Trigger mode

Select either AUTO or NORM with the TRIGGER MODE botton.

AUTO: Auto trigger is selected. If a trigger signal with the proper frequency and level is applied to the trigger circuit,

Figure 2-6. Setting of CH 3 COUPLING AC and DC



trigger is accomplished by turning the LEVEL control to an appropriate trigger level.

In the following cases, however, free-running sweeps occur due to the absence of trigger condition.

1. No trigger signal.
2. A trigger signal is too small.
3. The LEVEL control set outside the range of the trigger signal used.
4. A trigger signal with a frequency below 50 Hz.

NORM: Normal trigger is selected. If a trigger signal with the proper frequency level is input to the trigger circuit, trigger accomplished by turning the LEVEL contol to an appropriate trigger level.

In the following cases, however, sweeps stop and the instument gets into a ready condition due to the absence of trigger condition.

1. No trigger signal.
2. A trigger signal is too small.
3 The LEVEL control set outside the range of the trigger signal used.

Polarity

Push the LEVEL control for triggering in a positive-going slope, or pull it for triggering in a negative-going slope.

LEVEL

If the LEVEL control is near the center 0 position, a trigger is applied near 0 V.

The trigger level shifts in the positive direction if the LEVEL control is turned clockwise; or in the negative direction if the control is turned counterclockwise.

Sweep Rate Setting

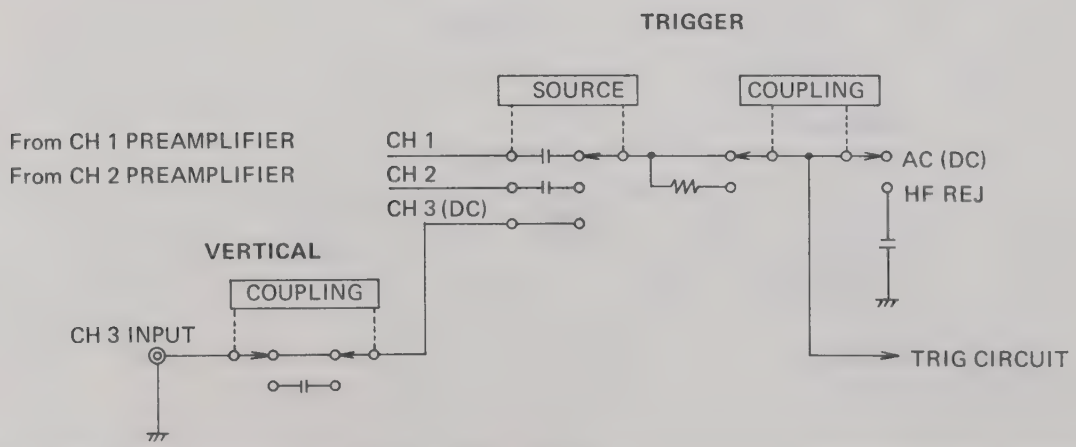
Many kinds of signals, some with a low repetition frequency and some with a high one, and some pulses with a fast rise and some with a slow rise, may be measured. To measure various kinds of signals in an appropriate repetitive cycle, it is necessary to select a suitable sweep rate.

When measuring signals with a low repetition freauency or slow rise pulses, for example, select a low sweep rate; and when measuring signals with a high repetition frequency or fast rise pulses, select a high sweep rate.

The TIME/DIV switch is the sweep rate control; and its VARIABLE control is for fine adjustment of sweep rate.

If the VARIABLE control is turned fully clockwise to the CAL position, each position of the TIME/DIV switch directly represents the sweep rate it indicates. If the VARIABLE control is tuned fully counterclockwise, the sweep rate pointed by the TIME/DIV switch is more than 2.5 times lower than indicated.

Figure 2-7. Diagram of couplings and source



Basic Operation for Use as a Storagescope

Similar to the basic operation described in the foregoing pages for use as an oscilloscope, a calibrated voltage is used to display input signals on the CRT screen and trigger is accomplished. In this case, the REMOTE/LOCAL switch on the rear panel must be set to LOCAL.

When using the instrument as an storagescope, the sweep rate range (TIME/DIV) available is from 0.1 msec/div to 10 sec/div. If the sweep rate is set to 0.1 msec/div position, however, the memory length is made to 1 k words. In the CH 1 4 k WORD mode, the memory length for the sweep rates from 0.5 msec/div to 10 sec/div is 4 k words.

Writhing Input Signals In

1. Push the CLOCK button to release it to the out position.
2. Triggered by operating the instrument as an oscilloscope, and display input signals on the CRT screen.
3. Push the DISPLAY MODE button in the STORAGE position.
4. Push the STORAGE MODE SINGLE button in.
5. When the WRITE READY is pushed the WRITE BUSY (lamp) over it lights, and the input signals are written in the memory. After the input signals have been written in the memory, the WRITE BUSY lamp goes out. If the MEMORY CH 1 4 K WORD button is pushed in, only those signals applied to the CH 1 signal input connector are written in the memory to a 4 k words length.

Reading the Data Stored in the Memory

6. After writing the input signals in the memory as described in Step 5 above, the READ BUSY (lamp) automatically lights to read out the stored data on the CRT screen.
7. If continuous reperition of write and read is desired, push the MODE REPEAT button in. In this case, a cycle of a single write operation and 4 read operations is repeated.
8. If WATCH operation is desired, push the MODE WATCH button in. In this mode, only four TIME/DIV positions, that is, 10 sec, 5 sec, 0.2 sec, and 0.1 sec can be used.
9. To read the stored data out to a pen recorder, connect a cable to D/A OUT and PEN UP on the rear panel and to the pen recorder, push the MODE PEN button in. Next, turn the SET/START switch to the SET position and turn to the START position, and the stored data begins to be read out. To repeat this after a stop, turn

Figure 2-8. SLOPE and LEVEL

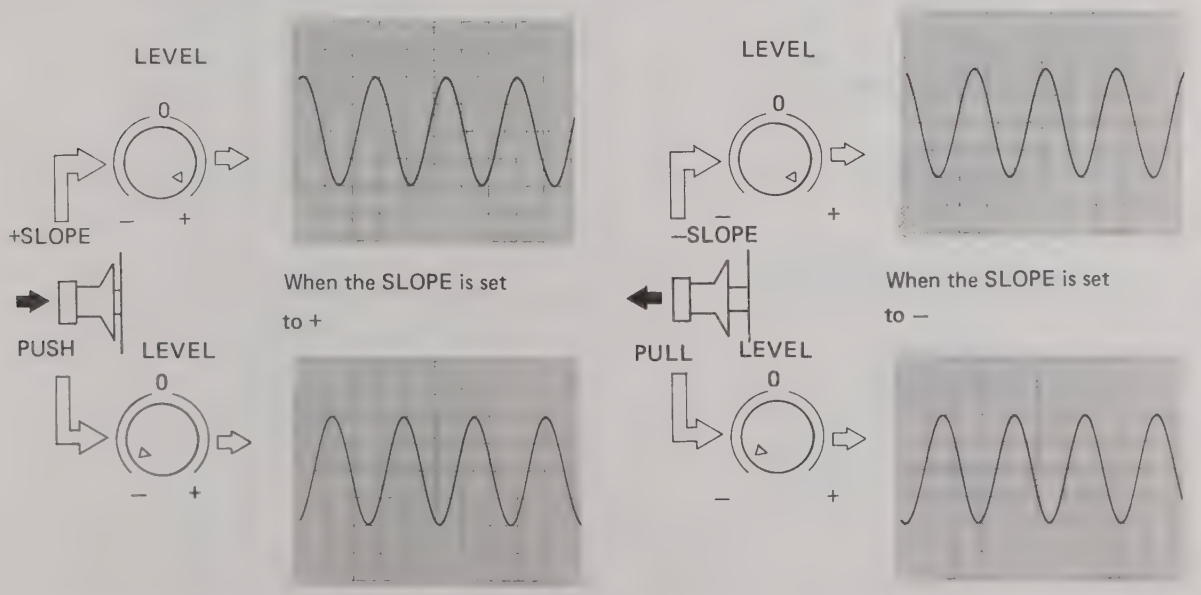
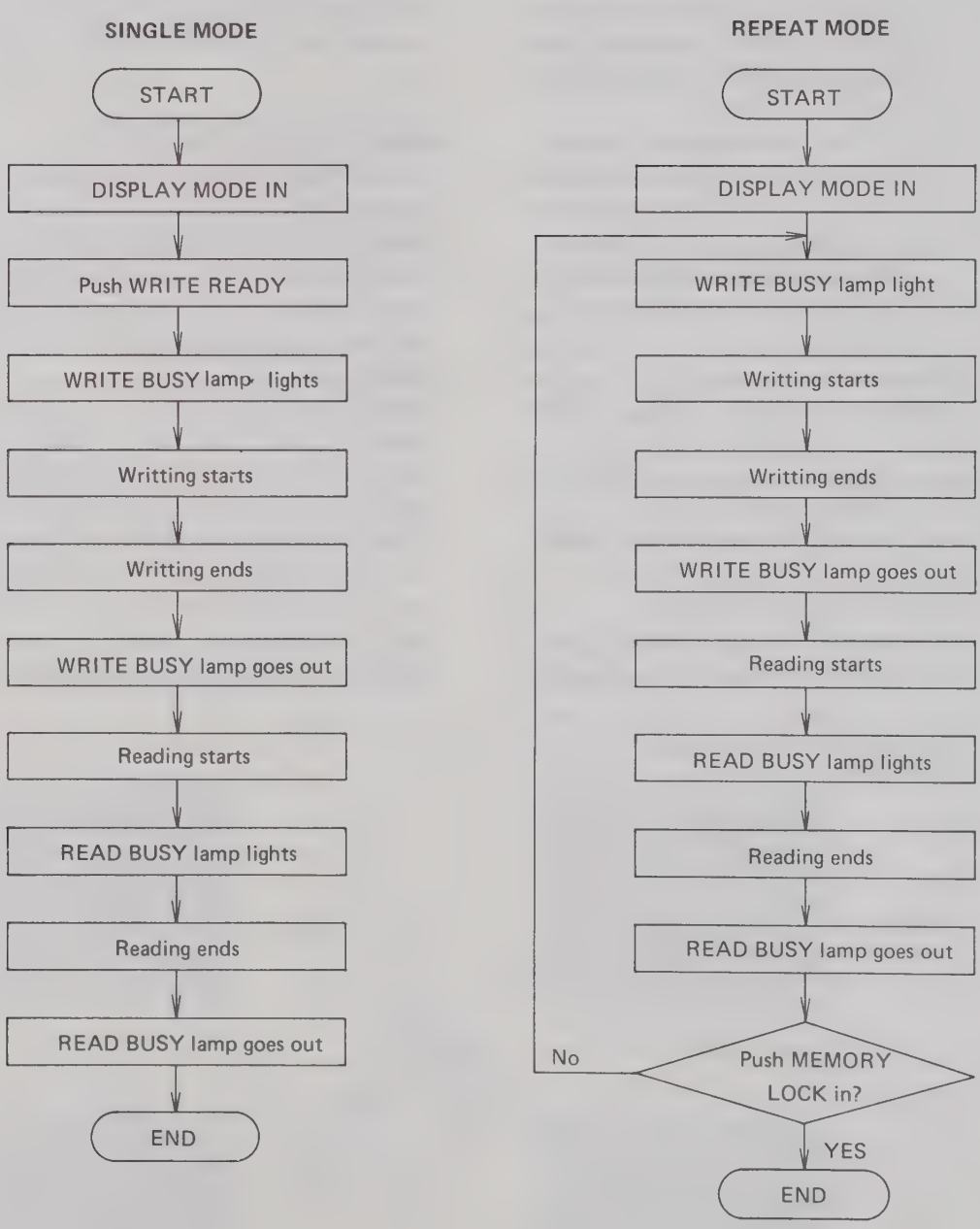
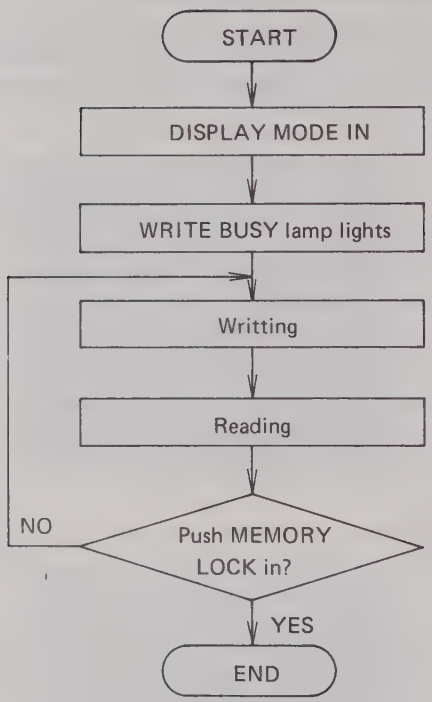


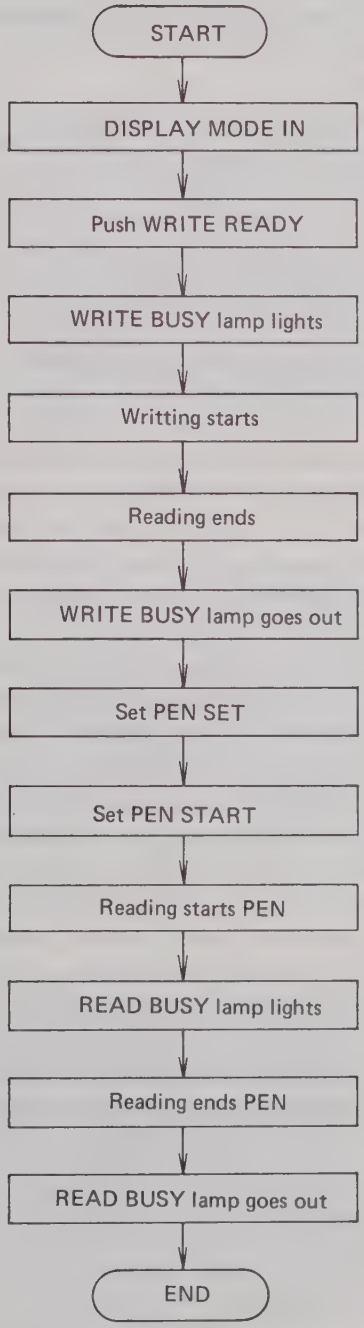
Figure 2-9. Flow chart of STORAGE MODE



WATCH MODE



PEN MODE



the SET/START switch up to SET and down to START again.

Either 5 sec/div or 10 sec/div position of the TIME/DIV switch can be used for recording with a pen recorder. The data read out to the pen recorder is simultaneously displayed on the CRT screen. When writing data with an X-Y recorder,, use SWEEP OUT, CH 1 or CH 2 OUT, and PEN UP.

To read the stored data out with an external clock, push the CLOCK button in, and apply a TTL level clock pulse to EXT CLOCK INPUT.

Write Deflection Factor Setting

The CRT screen of the SS-5802 has 8-divisions vertical graticule which is equal to full-scale of the analog to digital converter (8 bit). Since to record the analog input signals with high resolution, it is better to set the VOLTS/DIV switch to higher deflection factor position. If the VOLTS/DIV switch is set to lower deflection factor position against the amplitude of input signals, the resolution is gone down, and in this time especially, it is unwarrantable to observe of the input signal which has a sudden change.

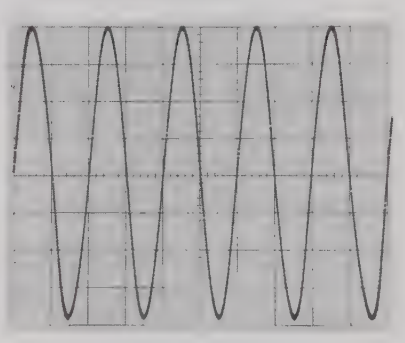
The Figure 2-10 is shown that the comparison waveforms depend on the CRT screen which is applied with same amplitude is written with differential vertical difflection factor. The (a) of Figure 2-10 which is reproduced the waveforms on the CRT screen of the SS-5802 with 8 divisions vertical graticule is recorded the input signal with 8 divisions (8-bit resolution) amplitude and the (b) which is also reproduced the waveform on the CRT screen of the SS-5802 with 8 divisions vertical graticule is recorded the input signal with 1 division (5-bit resolution) amplitude, and the (c) which is reproduced the waveform of partial inputing waveform on the CRT screen of the SS-5802 is recorded the input signal with over-scale amplitude.

It can be possible to observe as (c) when the part of input signal is exactly obsered to larger amplitude.

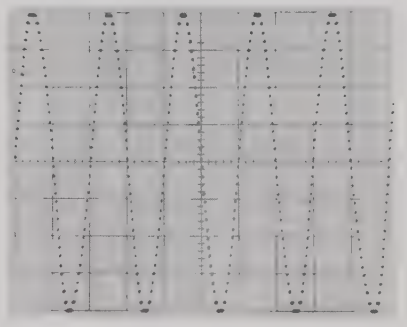
–DELAY Setting

An oscilloscope cannot display input signals on the CRT screen unless a trigger pulse is generated. The SS-5802, however, can display input signal even before a trigger pulse is generated by writing the input signal in the memory and then reading them out on the screen by using minus delay. This capability is useful for observing unpredictable signals or detecting electronic circuit troubles.

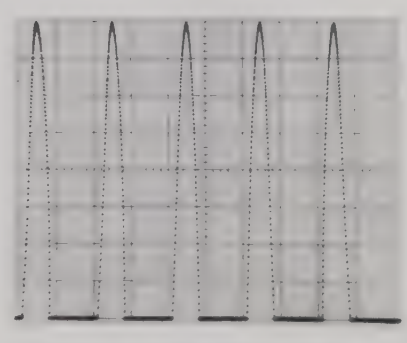
Figure 2- . Reading waveform which are written in the digital memories with the differential vertical deflection factors.



(a)



(b)



(c)

The SS-5802 permits instant identification of where a trigger pulse is generated on the screen with its –(minus) DELAY (DIV) setting.

In the waveform (a), figure 2-11, a trigger pulse is generated at position 0 at the left end of the scale. No part of the input signal before the trigger pulse generation is displayed. In the waveform (b), figure 2-11, a trigger pulse is generated 2.5 divisions right of the left end of the scale. The 2.5 divisions on the left represent the signal prior to the trigger pulse generation; and the 7.5 divisions on the right, the signal after that.

In the waveform (c), figure 2-11, trigger pulse is generated 2.5 divisions left of the right end of the scale. The 7.5 divisions on the left represent the signal prior to the trigger pulse generation: and the 2.5 divisions on the right, the signal after that.

Note: When using a –DELAY setting in writhing signals before trigger pulse generation, push the TRIGGER MODE button in to the NORM position.

WATCH Operation

Normally, the MODE REPEAT button is pushed in if repeated write and read of input signals is desired. If a clock that repeats itself very slow is used for writing input signals in (at a low TIME/DIV rate), it takes a considerable time for them to be written in, and it is not possible to observe input signals that might be applied in the meantime.

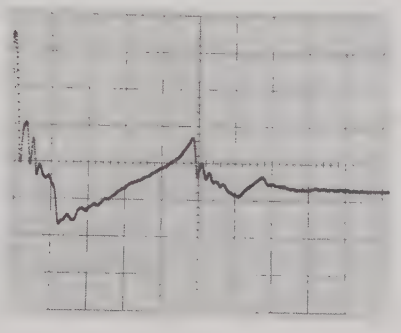
The SS-5802 solves this problem with the WATCH mode. If the WATCH button is pushed in, each time data for a word is written in, the new input data is displayed at the right end of the CRT screen. As additional data is written in, the data display shifts to the left word by word. Thus, input signals can be written in while watching them on the CRT screen.

In WATCH operation, select on of the 4 TIME/DIV positions from 10 sec/div to 0.1 sec/div.

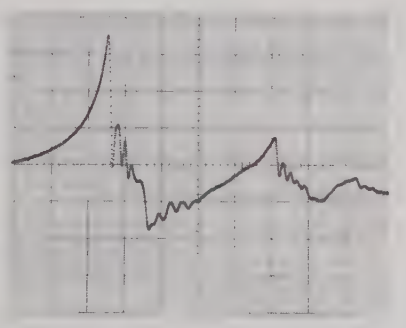
Locking Written Signal

If the MEMORY CH 1 or CH 2 button is pushed in, the signals applied to CH 1 or CH 2 INPUT and written in the memory can be locked. If new signals are applied while the signals stored in the memory is locked, the new signal will not be written the memory.

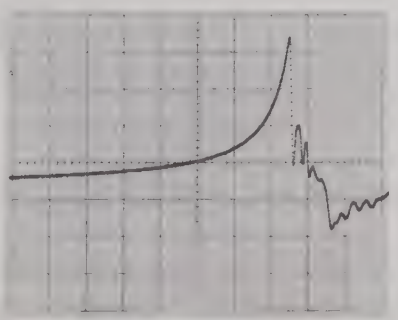
Figure 2-6. Reading wave forms which are written in the digital memories with the minus (–) DELAY function.



(a) When –DELAY is set to 0



(b) When the –DELAY is set to 2.5



(c) When the –DELAY is set to 7.5

<CAUTION>
- If the CH 1 4 K WORD button is pushed in, CH 2 is unlocked.
- If CH 1 or CH 2 is locked, CH 1 or CH 2 OUT may get out of synchronization with GATE OUT.

Write Channel and Memory Length

The SS-5802 has a memory length of 2048 words for CH 1 and CH 2 in normal operation, but if the MEMORY CH 1 4 K WORD button is pushed in, the memory length for signals applied to CH 1 INPUT is increased to 4096 words. If this mode is selected, the sweep rate ranges from 0.5 msec/div to 10 sec/div.

Reading Out to Pen Recorder

The sweep rate of either 5 sec (25 msec/word) or 10 sec (50 msec/word) may be selected with the TIME/DIV switch in reading the signal stored in the memory out to a pen recorder as suitable to recording time on the pen recorder. (If a pen recorder that can adjust itself to read out time is used, other sweep rates can also be used.)

When reading data out to a pen recorder for recording, connect the PEN UP terminal, SWEEP OUT, and D/A OUT on the rear panel to the pen recorder.

After writing signals in the memory in storage operaion, turned the SET/START switch up to the SET position, and push the PEN button in. Next, push the SET/START down to the START position to start the pen recorder. The data is displayed on the CRT screen simultaneously as it is recorded by the pen recorder. If the CH 1 4 K WORD button is pushed in, the speed is doubled per word.

Observing Realtime Waveform and Storage Waveform

Push in the DISPLAY MODE button to the STORAGE position, push in the V MODE TRI (REAL)button in, and apply signals to the CH 1 and CH 2 INPUT connectors for storage operation.

When the triple-operation, two signals which are applied to the CH 1 and CH 2 INPUT connectors (realtime waveforms)and storaged signal in the memory which was applied to the CH 2 INPUT connector, are displayed on the CRT screen.

In this case, however, a sweep rate must be selected within one of the range from 0.1 msec/div to 10 sec/div with the TIME/DIV switch.

APPLIED OPERATIONS FOR SIGNAL OBSERVATION

Usually, an oscilloscope has various convenient functions for observing signals to be measured. The following description refers to operating methods which may be applied to observing signals by using these functions after mastering the basic operations.

Operation for Dual-Trace Observation

As mentioned in the section on basic operations, the SS-5802 used as a dual-trace oscilloscope can display two signals measured on the CRT screen. In observing two signals that have the same frequency, stabilized trigger operation can be assured by selecting the trigger signal from the channel to which a signal with a low noise level is applied (provided that trigger condition is established). When observing two signals it is necessary to select the trigger signal from the channel to which the signal that has the lower frequency than the other is applied. If the opposite choice is made, the signal with the lower frequency is displayed in double or triple waveforms. In measuring a phase difference, the channel to which a signal having an advance phase over the other must be selected.

Dual-trace observation is available in either the ALT (alternate) sweep mode or the CHOP (chopped) sweep mode. By using the ALT or CHOP mode as appropriate, dual-trace observation can be made at sweep rate from 0.5 μsec/div to 10 sec/div.

Dual-Trace Observation in the ALT Mode

The ALT mode is suitable for waveform observation at sweep rates of 0.5 sec/div to 1 msec/div. In the ALT mode, sweeps occur alternately between CH 1 and CH 2.

If a sweep rate of lower than 1 msec/div is selected, two signals cannot be observed simultaneously.

Dual-Trace Observation in the CHOP Mode

The CHOP mode is suitable for waveform observation at sweep rates of 1 msec/div to 10 sec/div.

In the CHOP mode, CH 1 and CH 2 sweeps are switched from one to the other about every 250 kHz, and signals faster than 1 msec/div can be hardly observed on the CRT screen as their traces turn into dotted lines.

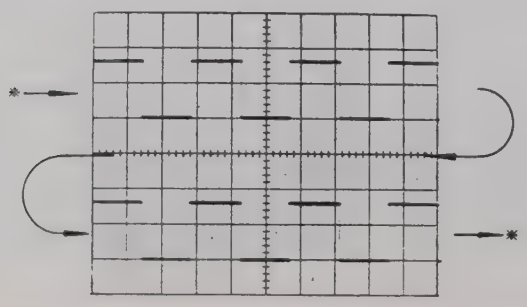
Operation for Triple-Trace Observation

The SS-5802 can simultaneously display up to three signals on the CRT screen aside from the dual-trace capability described above.

If the TRI (REAL) button is pushed in, traces for CH 1, CH 2, and CH 3 are displayed on the CRT screen. Thus, by applying three signals to be measured to the respective input connectors, the three signals can be simultaneously observed.

Triple-trace observation can be made in the two sweep modes of ALT and CHOP. Use these two sweep modes appropriately as in dual-trace observation.

Figure 2-12.



Operation for observation of the Sum of Two Signals or their Difference

Observation in the ADD Mode

Apply signals to CH 1 and CH 2 INPUT connectors, and push the V MODE CH 1 and CH 2 buttons in simultaneously. Then the sum (CH 1 + CH 2) of the two signals can be observed. If the CH 2 POLAR button is pushed in (INV) then, the difference [(CH 1) + (−CH 2)] = CH 1 − CH 2 between the two signals can be observed.

The deflection factor can be independently adjusted for CH 1 and CH 2 in the ADD mode so select a range to suit the purpose.

In the ADD mode, the POSITION controls for CH 1 and CH 2 may be used for adjusting trace positions, but for accurate measurement, the two POSITION controls should be kept near at the midrange.

Operation for Enlarging Waveforms on Screen

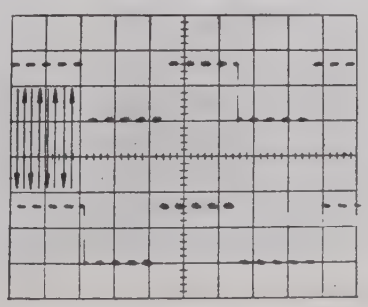
A Part of the displayed waveforms on the CRT screen can be enlarged to the horizontal direction for detailed observation by either of the two method below. (Real-time waveforms only.)

1. To use a faster sweep rate
2. To use the x10 MAG function

Using a Faster Sweep Rate

Use a faster sweep rate to extend the leading end of the waveform on the CRT screen timewise. If the center part or end of the waveform is extended by using a faster sweep

Figure 2-13.



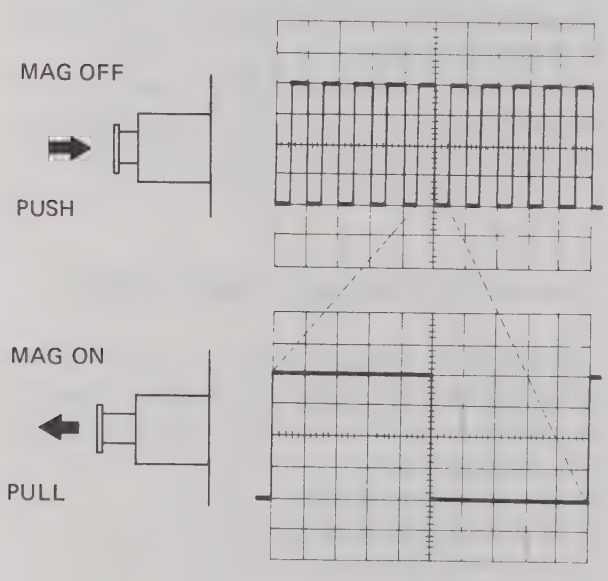
rate, those parts will go out of the CRT screen. In such a case, use the x10 MAG function to enlarge the waveform.

Magnifying Waveforms by x10 MAG

This method is mainly used to enlarge the center part or end of waveforms timewise. Move the desired part to the center of the CRT screen with the horizontal POSITION control, and pull the FINE (PULL x10 MAG) control knob so the desired part is enlarged 10 times in the horizontal direction. The trace length at this time is about 10 divisions, on the screen, but is increased actually to about 100 divisions, and can be observed from end to end with the horizontal POSITION and FINE control knob.

This methode is simple, but enlargement is limited to 10 times. The sweep rate to be used for enlarged observation is the value indicated by the TIME/DIV switch multiplied by 1/10. Thus, the fastest sweep rate can be extended to 50 nsec/div

Figure 2-14. Enlarging waveform by x10 MAG



Operation for Use as an X-Y Scope

If the V MODE X-Y button is pushed in, the instrument becomes an X-Y scope. The signal input to CH 1 drives the vertical axis; and the signal input to CH 2 drives the horizontal axis.

The Y-axis deflection factor is adjusted with the VOLTS/DIV for CH 1 and its VARIABLE control; and the X-axis deflection factor with the VOLTS/DIV for CH 2 and its VARIABLE control. If the VARIABLE controls are set to the CAL position, deflection factor is adjusted the value indicated by the VOLTS/DIV switch. Vertical position can be adjusted with the CH 1 POSITION contol; and horizontal position with the horizontal POSITION and FINE controls.

Phase differences and hysteresis curves can be observed by operating the SS-5802 as an X-Y scope.

Measuring Instructions

ADJUSTMENTS NECESSARY BEFORE MEASUREMENTS

When measuring inputs with the 10:1 (x10) passive probe, its phase adjustment is necessary for accurate measurement.It can be adjusted with the adjusting screwdriver (supplied as an accessory to the probe).

About 30 minutes of warmup is recommended for stabilizing operation before adjusting the probe phase and proceeding to the MEASURING PROCEDURES that follow.

10:1 (x10) Passive Probe Phase Adjustment

A mismatched probe phase can result in measuring the wrong waveform. Be sure to correctly adjust the probe before use. First, turn a VOLTS/DIV switch to the 5 mV/div position, and its VARIABLE control to CAL; connect the probe to the signal input connector and the CAL 0.3 V output terminal; and show a calibration voltage waveform with an amplitude of 6 divisions on the CRT screen.

Next, turn the variable capacitor of the probe. The waveform changes as shown in figure 3-1 b or c. Adjust the variable capacitor until the waveform is as shown in figure 3-1 a.

MEASURING PROCEDURES

Voltage Measurement

Quantitative Measurement

The quantitative measurement of voltage can be made by setting the VOLTS/DIV VARIABLE control to the CAL position. The measured value can be calculated by Equation (3-1)or (3-2).

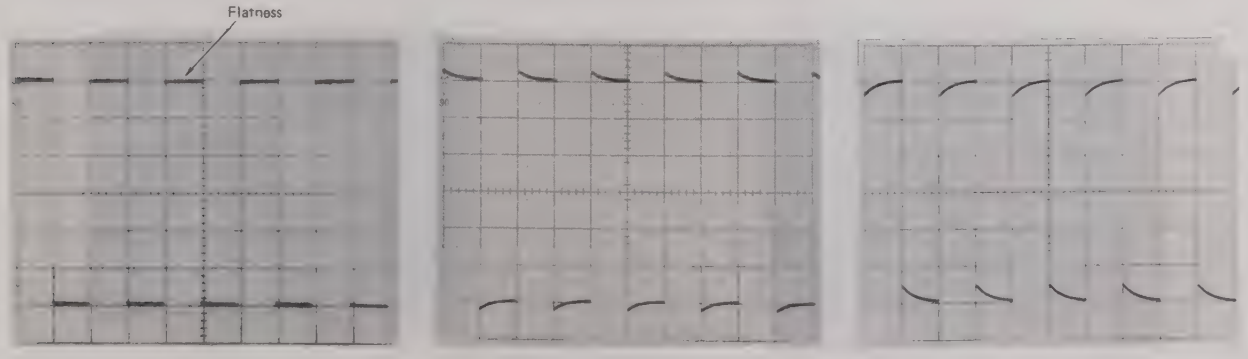
a. Measurement with the x1 position of the probe;
Voltage (V) = VOLTS/DIV setting value (V/div) x Displayed amplitude of input signal (div) . . . . . (3-1)

b. Measurement with the x10 position of the probe;
Voltage (V) = VOLTS/DIV setting value (V/div) x Displayed amplitude of input signal (div) x10 . . . . . (3-2)

DC Voltage Measurement

This instrument functions as a high input resistance, high sensitivity, quick response DC volt meter in order to measure DC voltage. Measurement procedure is as follows:
1. Set the sweep MODE switch to AUTO. and select a

Figure 3-1. Phasing of probe and displayed waveform



A. Correct compensation

B. Excessive compensation

C. Insufficent compensation

sweep rate so that the trace may not flicker.

2. Set the AC-GND-DC switch to GND. The vertical position of the trace in this case is used as 0-volt reference line as shown in Figure. 3-2. Adjust the vertical POSITION control in order to place the trace exctly on a horizontal graticule, which facilitates the reading of signal voltage.
3. Set the AC-GND-DC switch to DC, and apply the voltage to be measured to the input connector. The vertical diaplacement of the trace gives the voltage amplitude of the signal. When the trace shifts upward, the measured voltage is positive with regard to the ground potential. When the trace shifts downward, the voltage is negative.

Figure 3-2. DC Voltage measurement

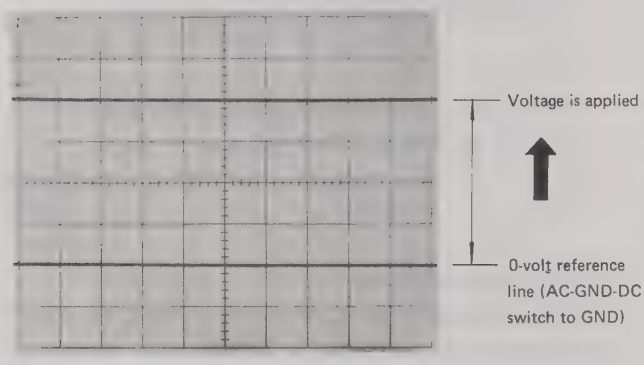
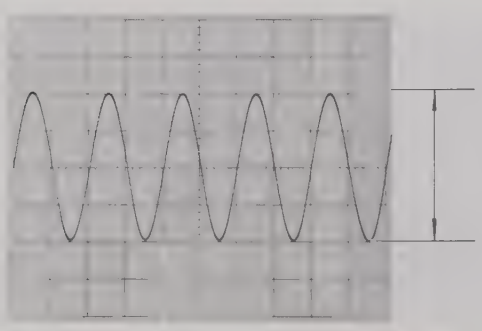


Figure 3-3. AC Voltage measurement



The voltage can be obtained by Equation (3-1) or (3-2).

AC Voltage Measurement

The measurement of the voltage waveform is performed as follows; Set the VOLTS/DIV switch in order to obtain the amplitude for easy reading, read the amplitude as shown in Figure 3-3 and calculate by Equation (3-1) or (3-2).

When the waveform superimposed on DC current is measured, set the AC-GND-DC switch to DC in order to measure the value including DC component, or set this switch to AC in order to measure AC component only.

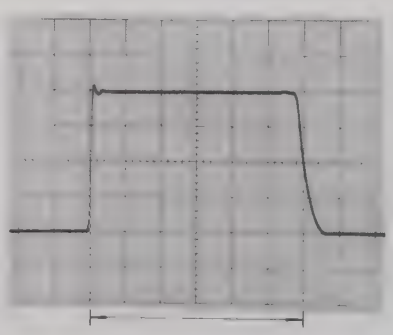
The measured value by means of this procedure is peak value (Vp-p). Effective value (Vrms) of a sine wave signal can be given by equation (3-3).

$$\text{Effective voltage (V rms)} = \frac{\text{Peak voltage (V p-p)}}{2\sqrt{2}} \quad \text{..(3-3)}$$

Time measurement

The time interval of two points on a signal waveform can be calculated as follows: Set the TIME/DIV VARIABLE control to CAL. read the setting values of the TIME/DIV and x5 MAG switches and calculate the time by Equation (3-4).

Figure 3-4. Pulsewidth measurement



Time (s) = TIME/DIV setting value (s/div)
x Length corresponding to the time to be measured (div)
x Reciprocal number of x5 MAG setting value. . . . . (3-4)

Where, the reciprocal number of the x5 MAG setting value is 1 when the sweep is not magnified, and 1/5 when the sweep is magnified.

Pulsewidth Measurement

The basic pulsewidth measurement procedure is as follows:

1. Display the pulse waveform vertically so that the distance between the top part of the pulse waveform and the horizontal center line of the graticule may be equal to the distance between the bottom part of the pulse and the horizontal center line as shown in Figure 3-4.
2. Set TIME/DIV switch in order to make the easy observation of the signal.
3. Read the distance between centers of rising and falling edges, i.e., the distance between two points at which pulse edges cross the horizontal center line of the graticule. Calculate the pulsewidth by Equation (3-4).

Rise (or Fall) Time Measurement

The rise (or fall) time measurement of the pulses is obtained as follows.

1. Display the pulse waveform vertically and horizontally in the same manner as for the pulsewidth measurement procedure.
2. Turn the horizontal POSITION control in order to set the upper 10% point of the waveform on the vertical center line of the graticule. (In Figure 3-5, the upper 10% point is 0.4 division below the top of the pulse since the displayed amplitude is 4 divisions.) Read the distance T_1 between the vertical center line and the point at which the rising (or falling) edge crosses the horizontal center line.
3. Shift and set the lower 10% point of the waveform to the vertical center line of the graticule as shown by the dotted line in Figure 3-5. Read the distance T_2 between the vertical center line and the point at which the rising

Figure 3-5. Rise (or fall) time measurement

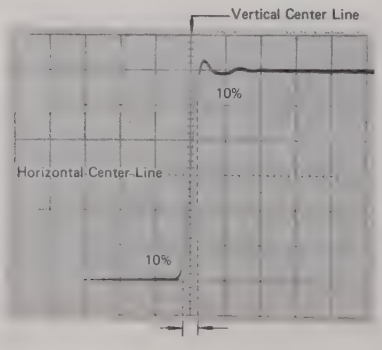


Figure 3-6. Frequency measurement (1)

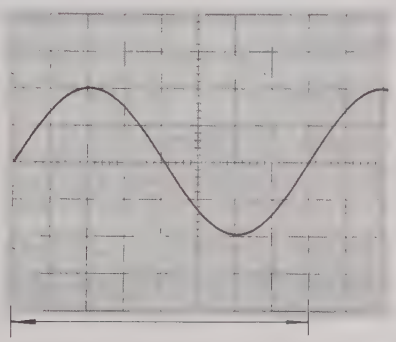
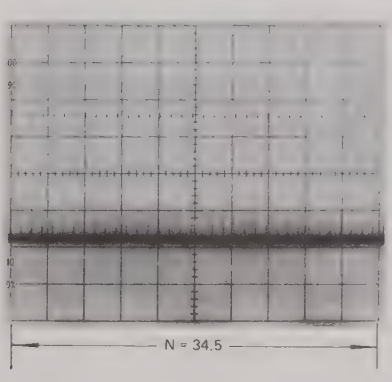


Figure 3-7. Frequency measurement (2)



(or falling) edge crosses the horizontal center line.

4. Calculate the rise (or fall) time by substituting the sum of T_1 and T_2 for Equation (3-4).

Frequency Measurement

Of the frequency measurement procedure, there are the following methods.

The first method: Calculate the one-cycle time (interval) of the input signal by Equation (3-4) as shown in Figure 3-6, and obtain th frequency by Equation (3-5).

$$\text{Frequency (Hz)} = \frac{1\ (c)}{\text{Period (s)}} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3\text{-}5)$$

The second method: Count the repetition number N per 10 divisions in the viewing area, and calculate the frequency by Equation (3-6).

$$\text{Frequency (Hz)} = \frac{N\ (c)}{\text{TIME/DIV setting value (s/div)} \times 10\ \text{(div)}} \quad \ldots\ldots (3\text{-}6)$$

When N is large (30 to 50), the second method can give a higher accuracy level than that obtained with the first method. This accuracy is approximately equal to the rated accuracy of sweep rate. However, when N is small, the count below decimal point becomes very ambiguous, which results in considerable error.

For the measurement of comparatively low frequencies having a simple pattern such as sine wave, square wave, triangle wave, and sawtooth wave, measurement with high accuracy can be effected by the follwing method: Operate the oscilloscope as an X-Y scope, make the Lissajou's pattern by applying the signal of which frequency is known, and read the necessay value.

Phase Measurement

Of the measurement of phase difference between two signals, there are the follwing two methods:

The first one is the Lissajou's pattern method by using the instrument as an X-Y scope. The phase difference of signals can be calculated form the amplitudes A and B of the pattern shown if Figure 3-8 and by Equation (3-7).

$$\text{Phase defference (deg)} = \sin^{-1}\frac{A}{B} \quad \ldots\ldots\ldots\ldots\ldots\ldots (3\text{-}7)$$

The second method is an application of dual-trace function Figure 3-9 shows an example of dual-trace display of leading and lagging sine wave signals having the same frequency. In this case, the SOURCE switch must be set to a channel which is connected to the leading signal, and set the TIME/DIV switch so that the length of 1-cycle of the displayed sine wave may be 9 divisions.

Figure 3-8. Phase difference measurement using ————

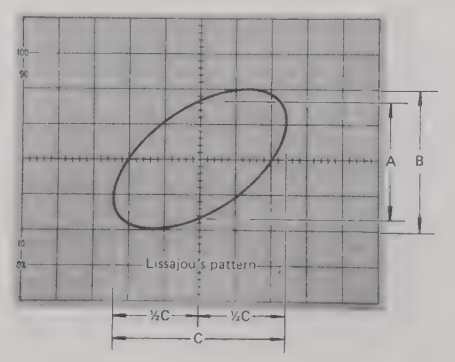
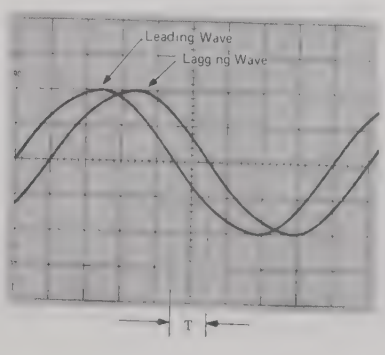


Figure 3-9 Phase difference measurement by dual-trace display



Then, 1-division graticule represents a waveform phase of 40° (1 cycle = 2π=360°). The phase difference between the two signals can be easily calculated by Equation (3-8).

Phase difference (deg)=T (div) x40°. . . . . (3-8)

Where, T is the distance between two points at which the leading and lagging signals cross the horizontal center line of the graticule.

Measuring the Signal Written in Memory

Note:

When measuring the signals written in the memory by displaying them on the CRT screen or reading them to on a paper of a pen recorder, turn the VOLTS/DIV and TIME/DIV switches the positions at which the signals were written in.

Stored Signal Voltage Measurement on Scope

To obtain the voltage at which signals were written in the memory from their waveforms displayed on the CRT screen, calculate them from the input deflection factor VOLTS/DIV settings used for writing them in by Equations (3-1) and (3-2).

Stored Signal Time Measurement on Scope

To obtain the time at which signals were written in the memory from their waveforms displayed on the CRT screen, calculate it from the sweep rate TIME/DIV setting used for writing them in by Equation (3-4).

Stored Signal Voltage Measurement with Pen Recorder

Use Equation (3-9) for calculating the voltage Vi at which a signal was written in from the signal waveform drawn on paper by a pen recorder.

Vi (V) = 2 x Input deflection factor (V/div) for writing the signal in x Output voltage (Vo) . . . (3-9)where

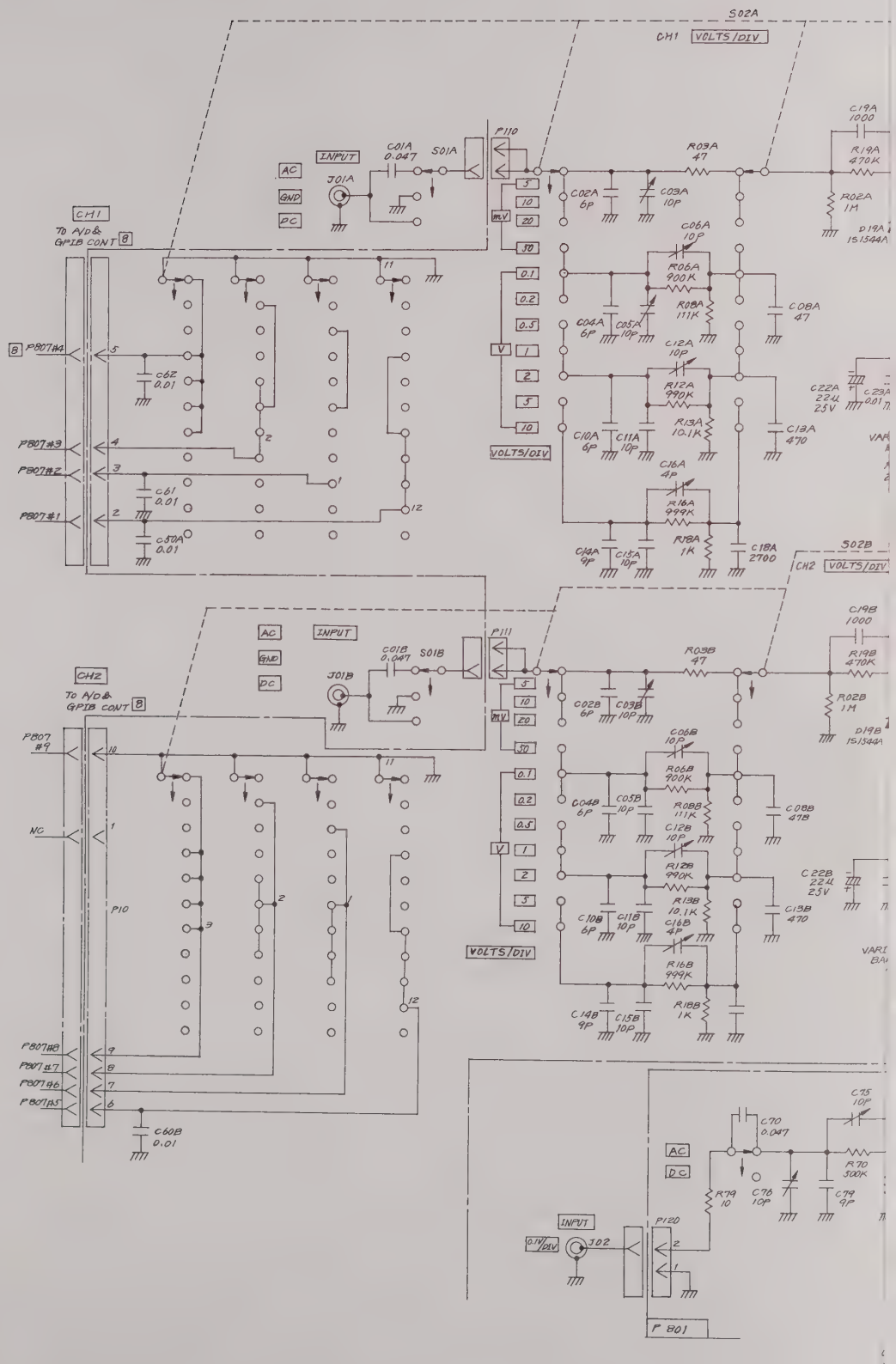
Output voltage V0 = Pen recorder input deflection factor x Signal amplitude on paper.

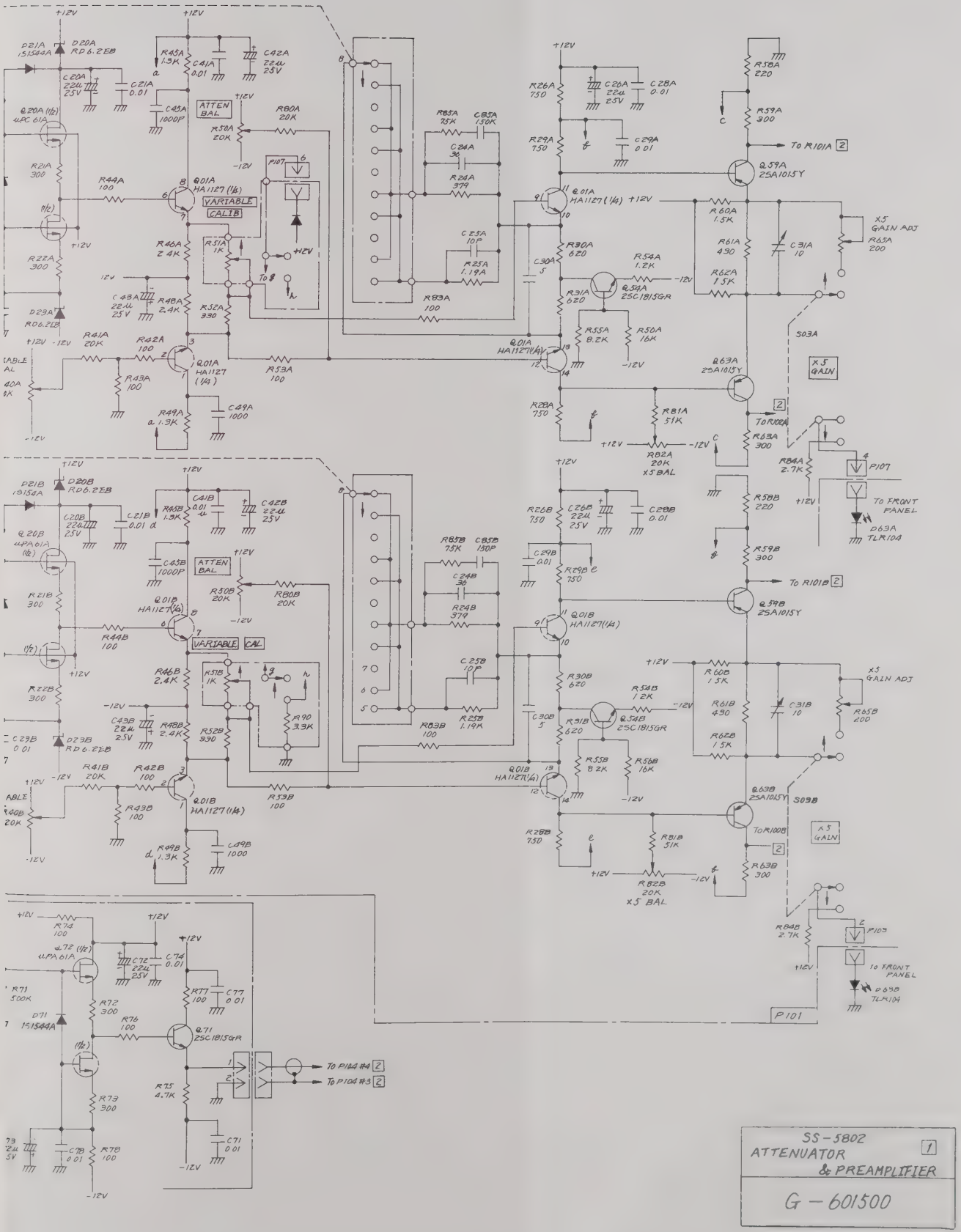
Stored Signal Time Measurement with Pen Recorder

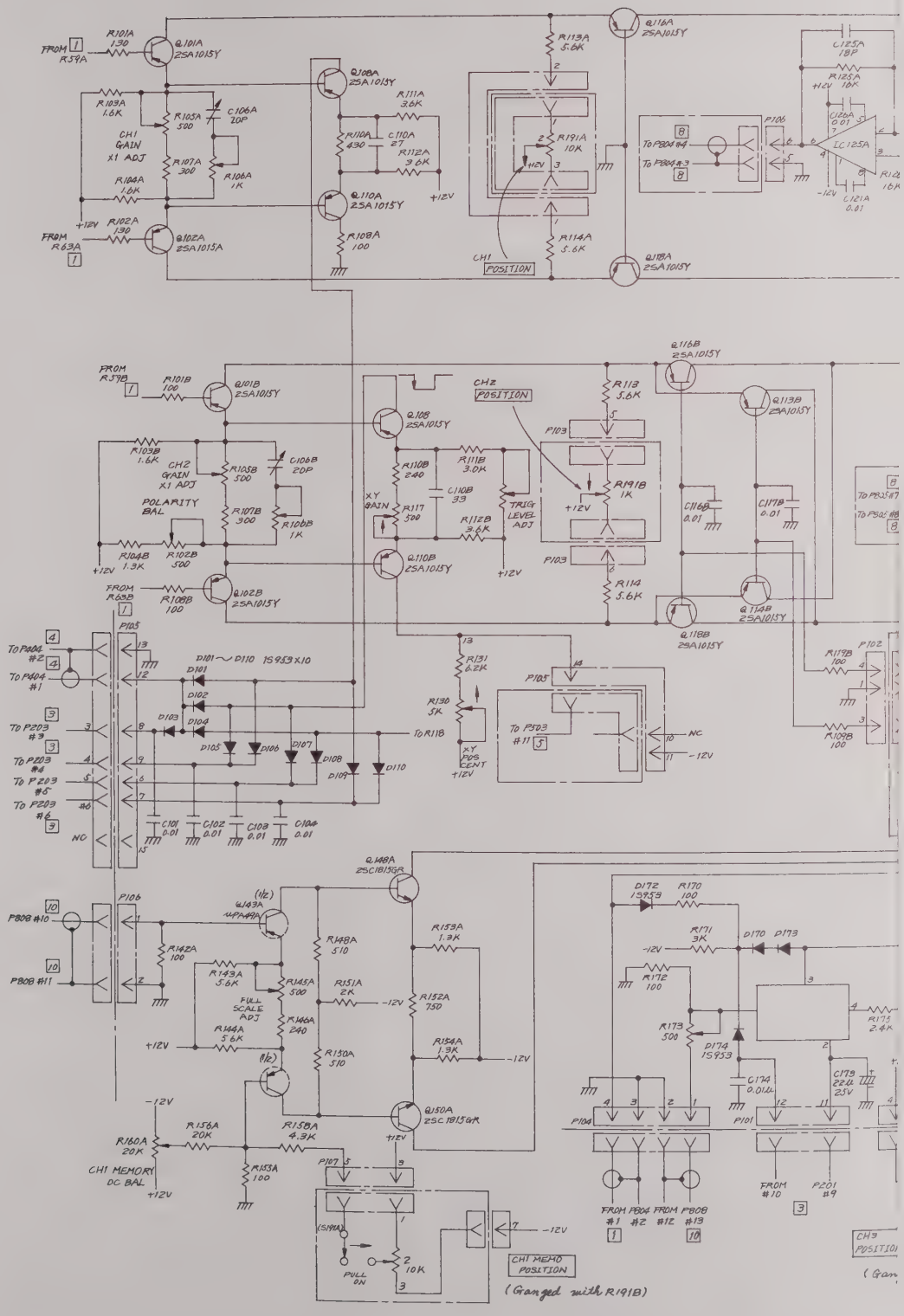
To obtaind the time T at which a signal was written in from the signal waveform drawn on paper by a pen recorder, substitute its wtire speed, read speed, and the paper feed speed of the pen recorder into Eauation (3-10).

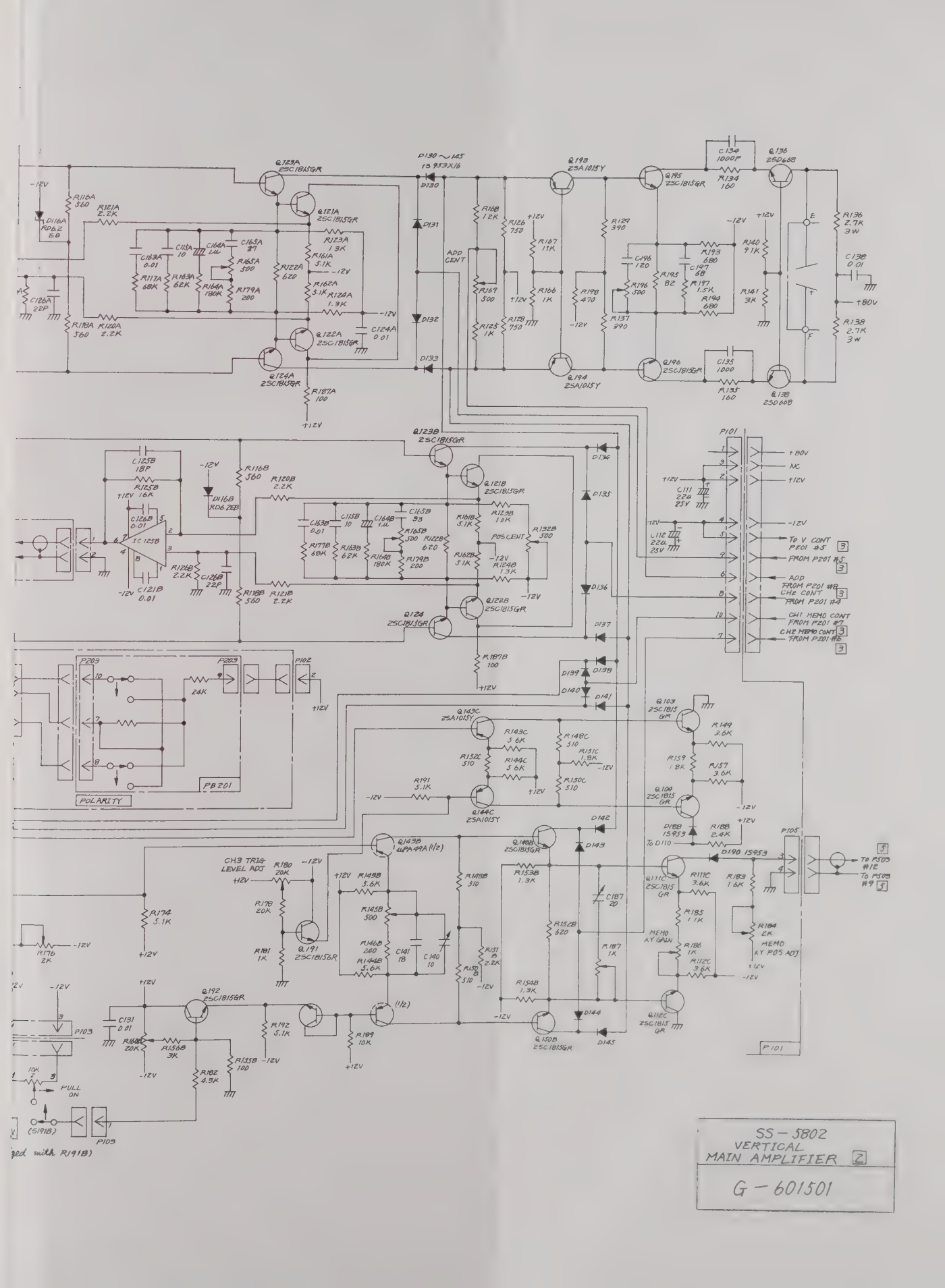
$$T\ (\text{sec/div}) = \frac{\text{Write speed (sec/div)}}{\text{Read speed (sec/div)}} \times \text{Paper feed speed of pen recorder (sec/div)} \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{(3-10)}$$

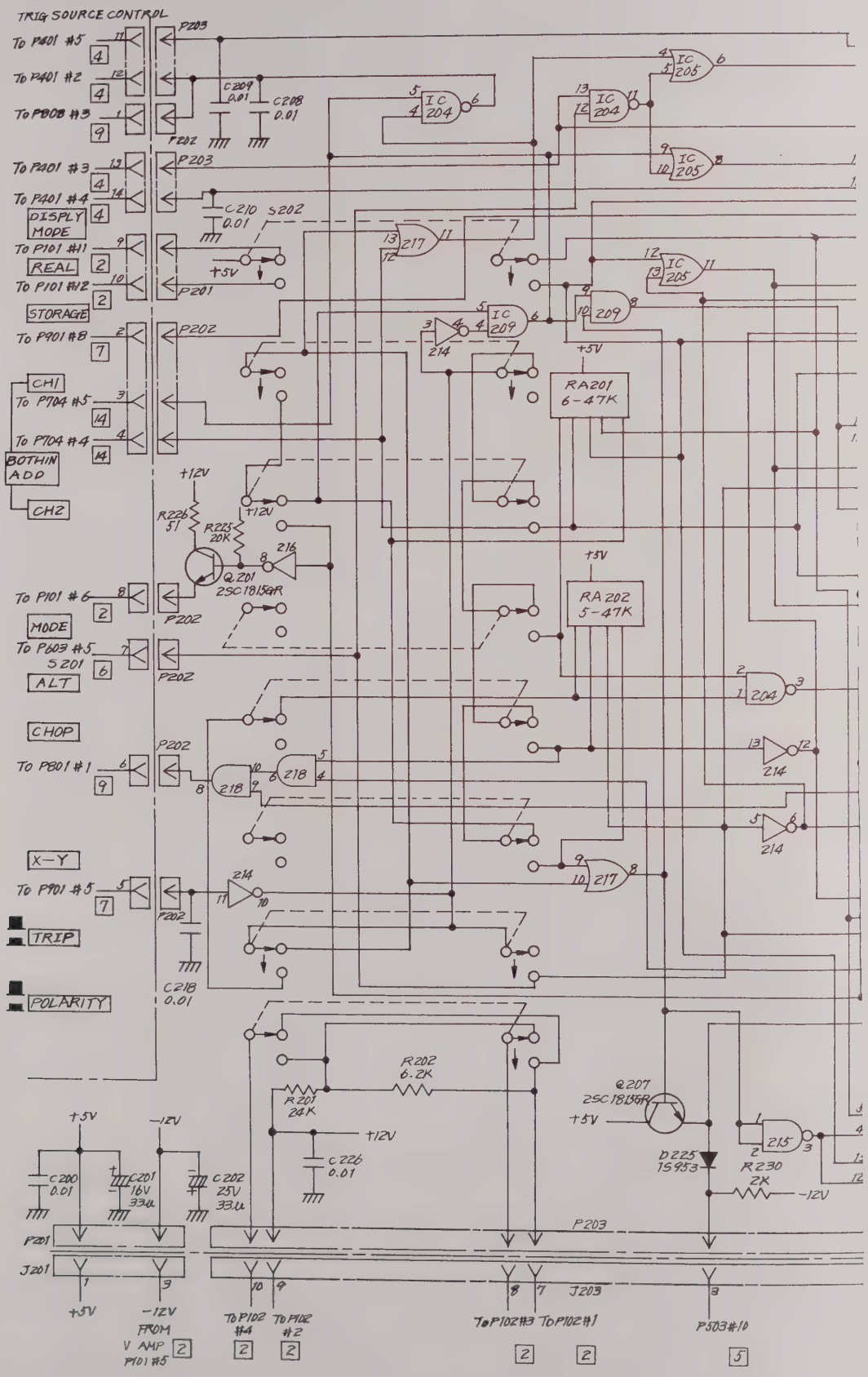
Notes

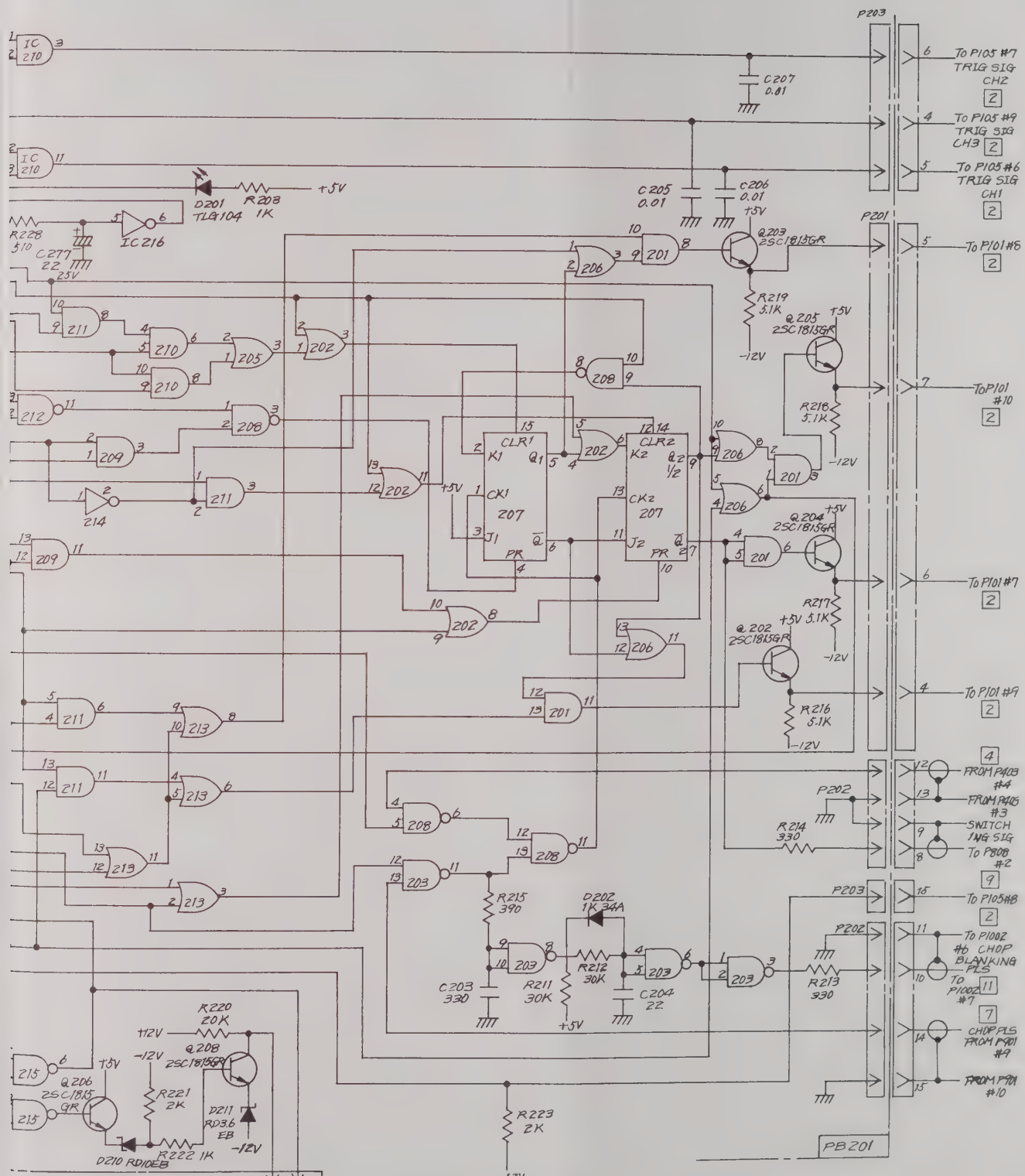

S02A
CH1 VOLTS/DIV
INPUT
AC
GND
DC
J01A
C01A 0.047
S01A
P110
R03A 47
C19A 1000
R19A 470K
R02A 1M
C02A 6P
C03A 10P
C06A 10P
R06A 900K
R08A 111K
C08A 47
C04A 6P
C05A 10P
C12A 10P
R12A 990K
R13A 10.1K
C13A 470
C10A 6P
C11A 10P
C16A 4P
R16A 999K
R18A 1K
C18A 2700
C14A 9P
C15A 10P
C22A 22U 25V
C23A 0.01
VOLTS/DIV
CH1
TO A/D & GPIB CONT
P807#4
P807#3
P807#2
P807#1
C62 0.01
C61 0.01
C60A 0.01
S02B
CH2 VOLTS/DIV
J01B
C01B 0.047
S01B
P111
R03B 47
C19B 1000
R19B 470K
R02B 1M
C02B 6P
C03B 10P
C06B 10P
R06B 900K
R08B 111K
C08B 47
C04B 6P
C05B 10P
C12B 10P
R12B 990K
R13B 10.1K
C13B 470
C10B 6P
C11B 10P
C16B 4P
R16B 999K
R18B 1K
C14B 9P
C15B 10P
C22B 22U 25V
CH2
TO A/D & GPIB CONT
P807#9
NC
P807#8
P807#7
P807#6
P807#5
P10
C60B 0.01
C70 0.047
C75 10P
R70 500K
R79 10
C76 10P
C78 9P
P120
J02
0.1V/DIV
P801


ATTEN BAL
VARIABLE CALIB
VARIABLE CAL
X5 GAIN ADJ
X5 GAIN
X5 BAL
TO FRONT PANEL
TO R101A
TO R101B
TO R100B
TO P104 #4
TO P104 #3
P101
SS-5802
ATTENUATOR & PREAMPLIFIER
G-601500


CH1 GAIN X1 ADJ
CH1 POSITION
CH2 GAIN X1 ADJ
POLARITY BAL
CH2 POSITION
XY GAIN
TRIG LEVEL ADJ
XY POS CENT
FULL SCALE ADJ
CH1 MEMO DC BAL
CH1 MEMO POSITION
(Ganged with R191B)
FROM R39A
FROM R63A
FROM R39B
FROM R63B
To P804 #2
To P804 #1
To P203 #3
To P203 #4
To P203 #5
To P203 #6
To R118
To P803 #11
To P804 #4
To P804 #3
FROM P808 #1 #2 #12 #13
FROM #10
P201 #9
NC
-12V
+12V


SS-5802
VERTICAL
MAIN AMPLIFIER 2
G-601501

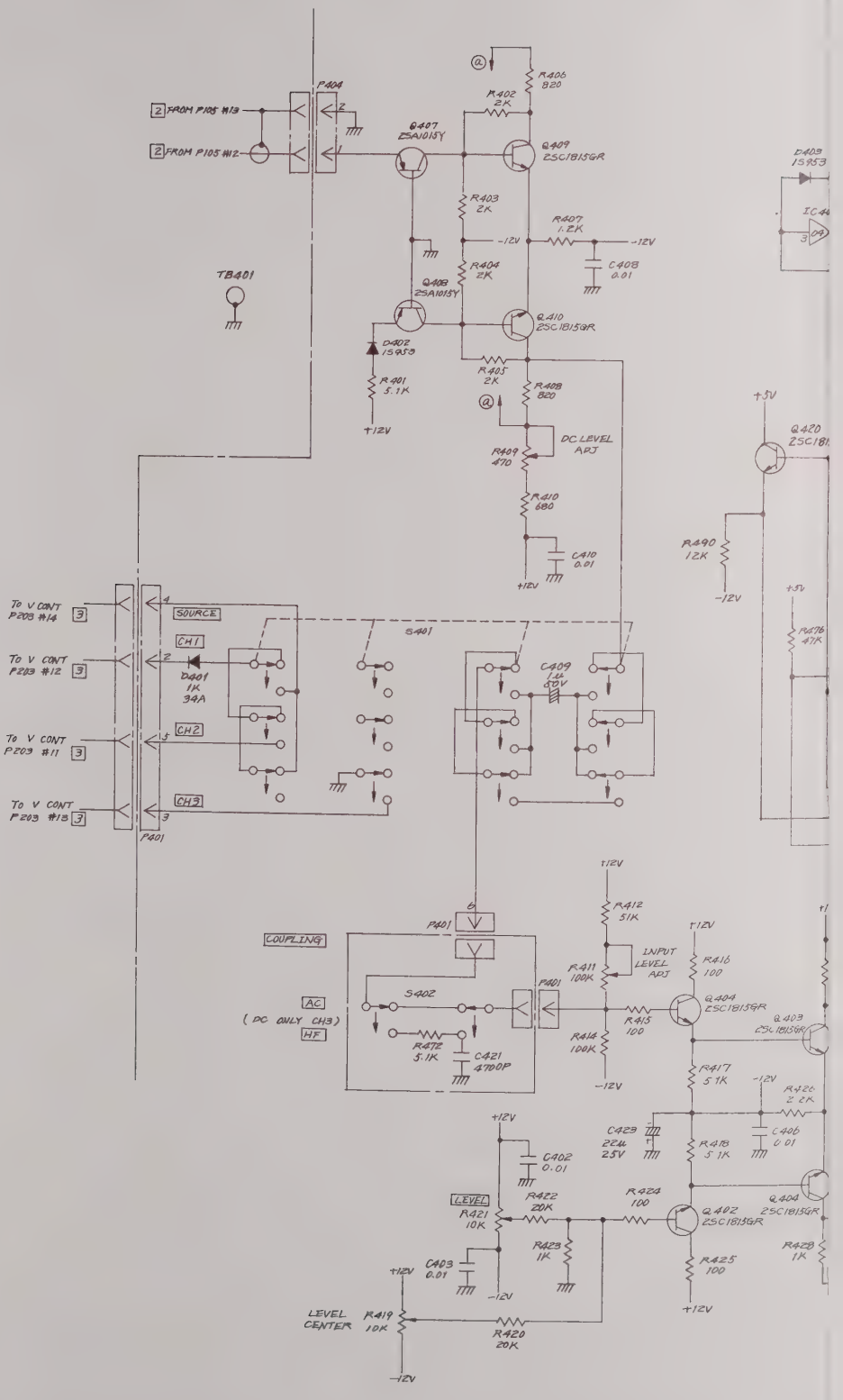

TRIG SOURCE CONTROL
To P401 #5
To P401 #2
To P808 #3
To P401 #3
To P401 #4
DISPLY MODE
To P101 #11
REAL
To P101 #12
STORAGE
To P901 #8
CH1
To P704 #5
To P704 #4
BOTHIN ADD
CH2
To P101 #6
MODE
To P603 #5
S201
ALT
CHOP
To P801 #1
X-Y
To P901 #5
TRIP
POLARITY
P203
P202
P201
C209 0.01
C208 0.01
C210 0.01
S202
+5V
IC 204
IC 205
IC 209
Z17
Z09
Z14
RA201 6-47K
RA202 5-47K
+12V
R226 51
R223 20K
Q201 2SC1815GR
Z16
Z04
Z18
C218 0.01
R202 6.2K
R201 24K
C226 0.01
Q207 2SC1815GR
D225 1S953
Z15
R230 2K
-12V
C200 0.01
C201 16V 33u
C202 25V 33u
J201
J203
FROM V AMP P101 #5
To P102 #4
To P102 #2
To P102 #3
To P102 #1
P503 #10

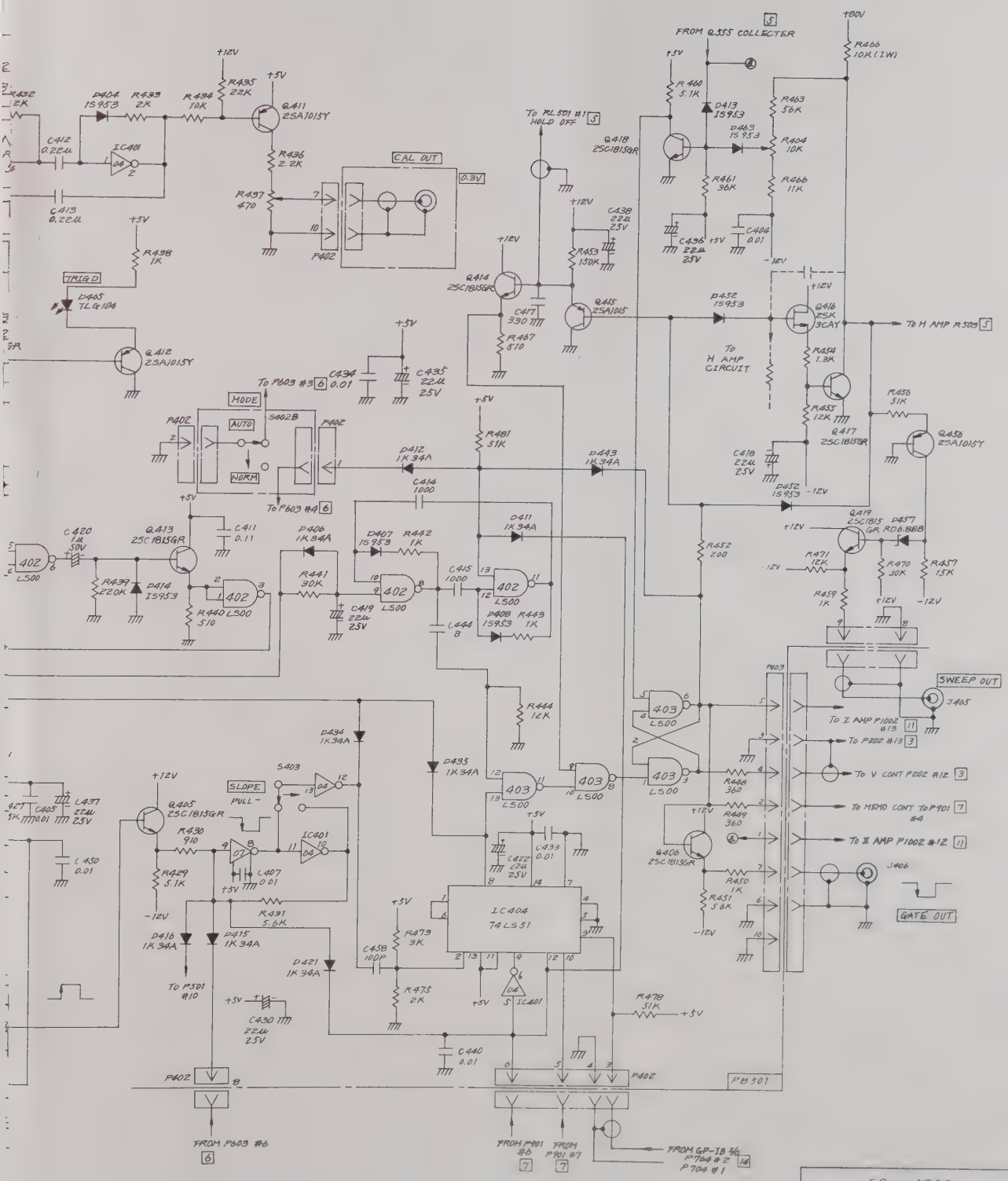


Circuit No.	IC Name
IC 213 217 202 205 206	SN74LS32N
IC 215 212 203 204 208	SN74LS00N
IC 214	SN74LS04N
IC 211 218 201 209 210	SN74LS08N
IC 216	SN7416N
IC 207	SN74LS112N

SS – 5802
V CONTROL 3

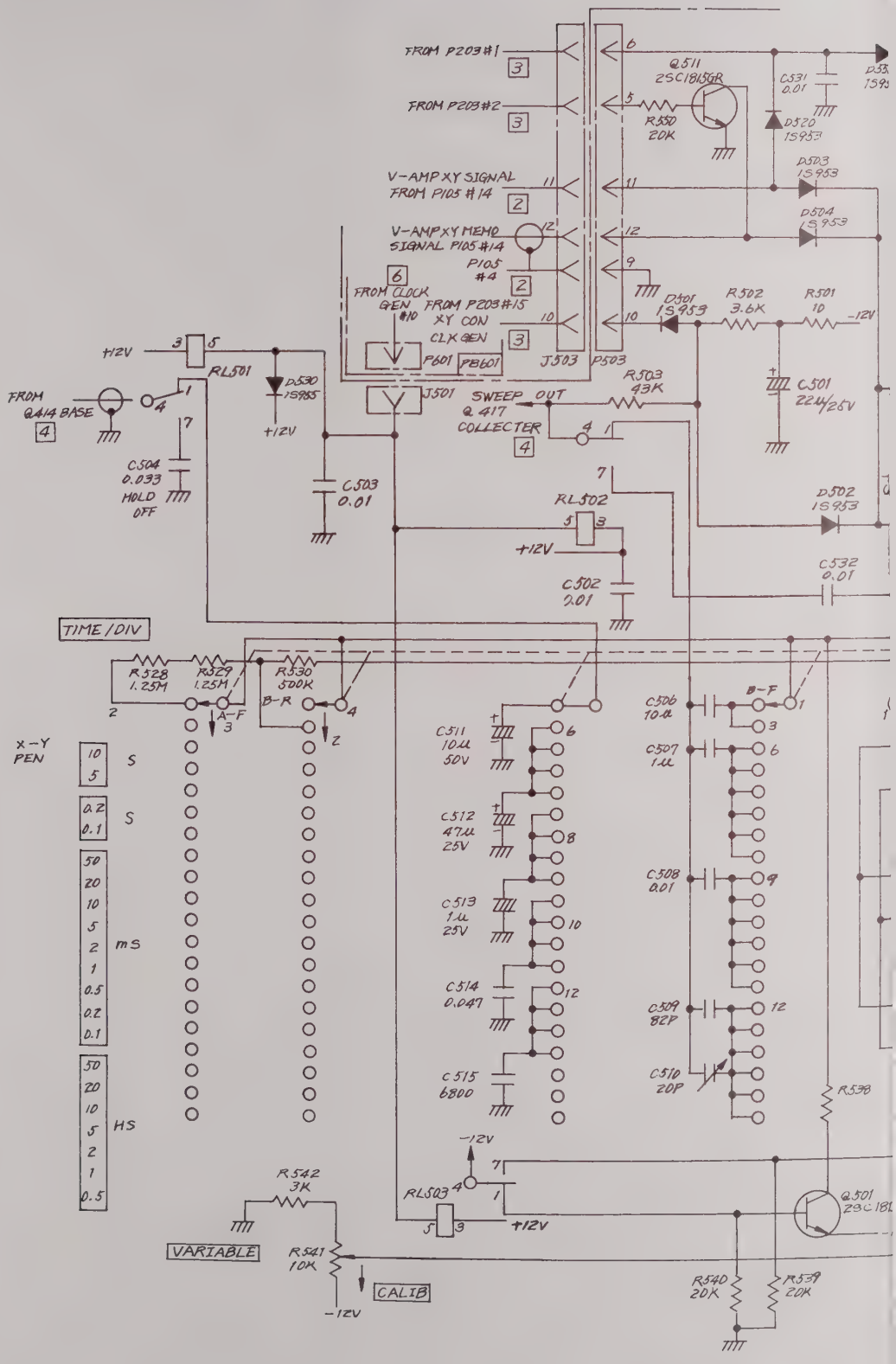
K – 607272

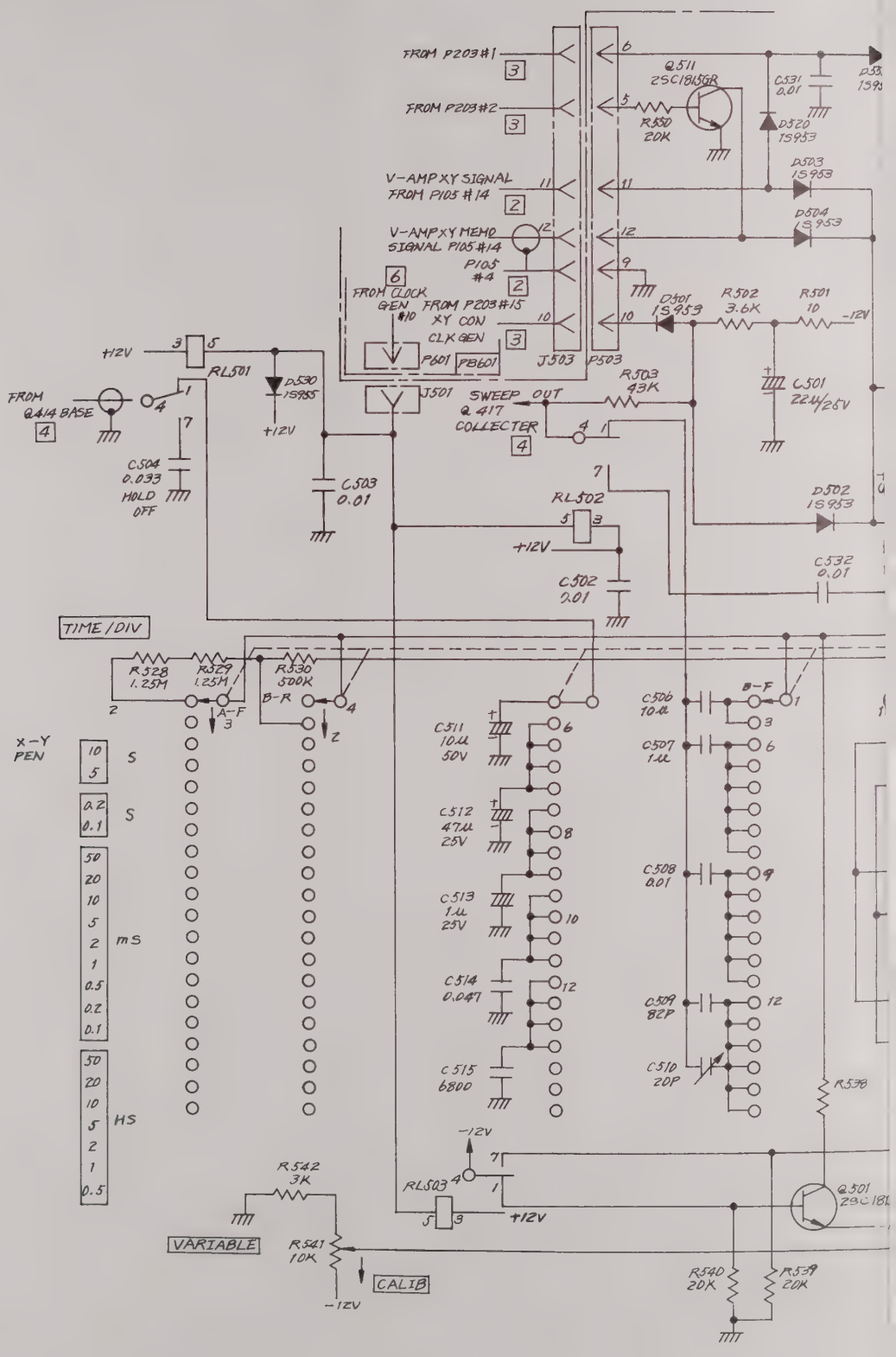

FROM P105 #13
FROM P105 #12
P404
Q407 2SA1015Y
Q409 2SC1815GR
R406 820
R402 2K
R403 2K
R404 2K
R407 1.2K
C408 0.01
Q408 2SA1015Y
Q410 2SC1815GR
D402 1S953
R401 5.1K
R405 2K
R408 820
DC LEVEL ADJ
R409 470
R410 680
C410 0.01
TB401
+12V
-12V
To V CONT P203 #14
To V CONT P203 #12
To V CONT P203 #11
To V CONT P203 #13
SOURCE
CH1
CH2
CH3
D401 1K 34A
S401
C409 4u 50V
P401
COUPLING
AC
(DC ONLY CH3)
HF
S402
R412 51K
R411 100K
INPUT LEVEL ADJ
R413 100
R414 100K
R416 100
Q404 2SC1815GR
Q403 2SC1815GR
R417 5.1K
R426 2.2K
R427 5.1K
C421 4700P
C423 22u 25V
C406 0.01
C402 0.01
LEVEL
R421 10K
R422 20K
R423 1K
R424 100
Q402 2SC1815GR
R428 1K
R425 100
C403 0.01
LEVEL CENTER
R419 10K
R420 20K
D403 1S953
IC44
Q420 2SC181
R490 12K
R476 47K
+5V

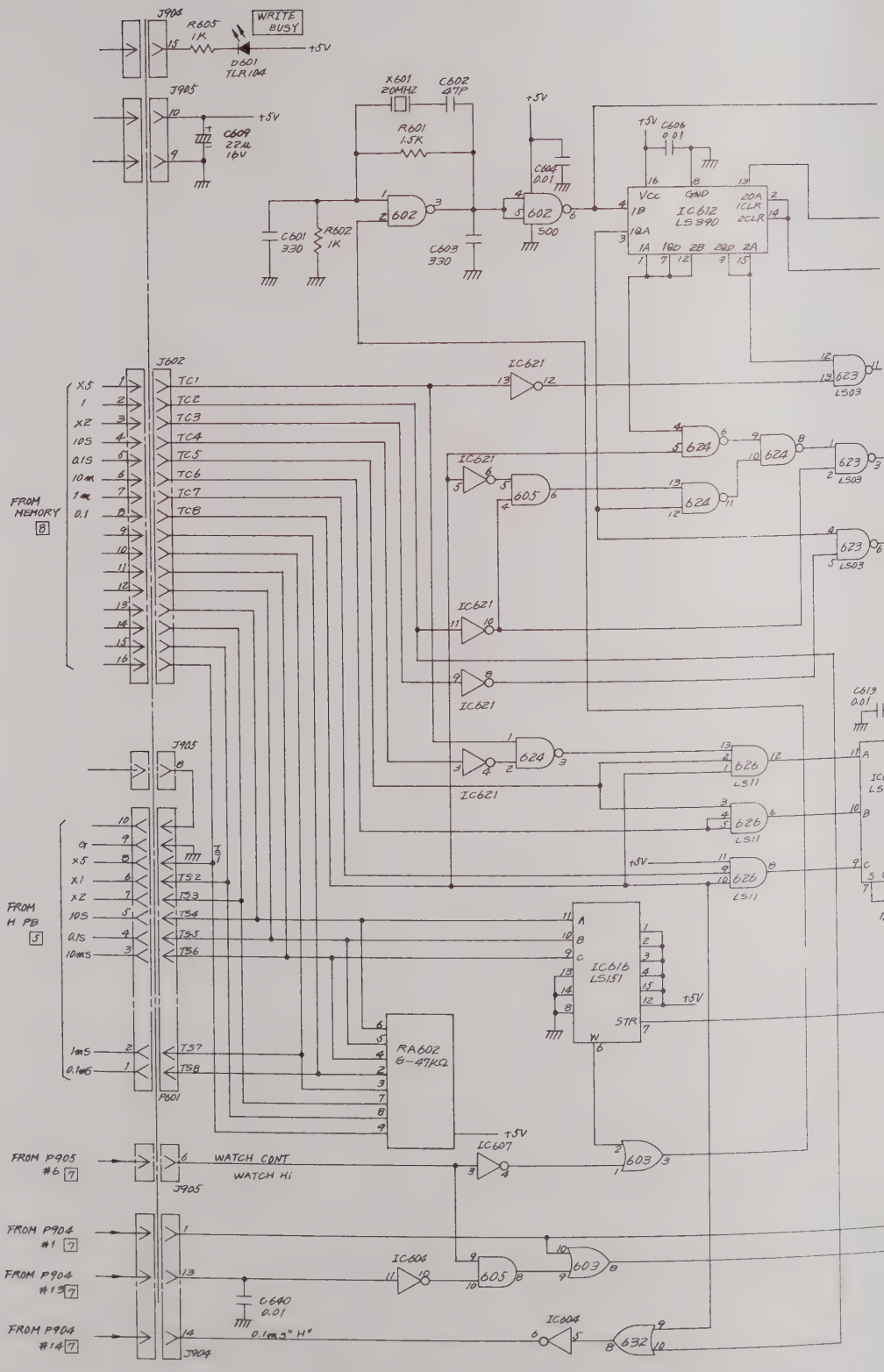


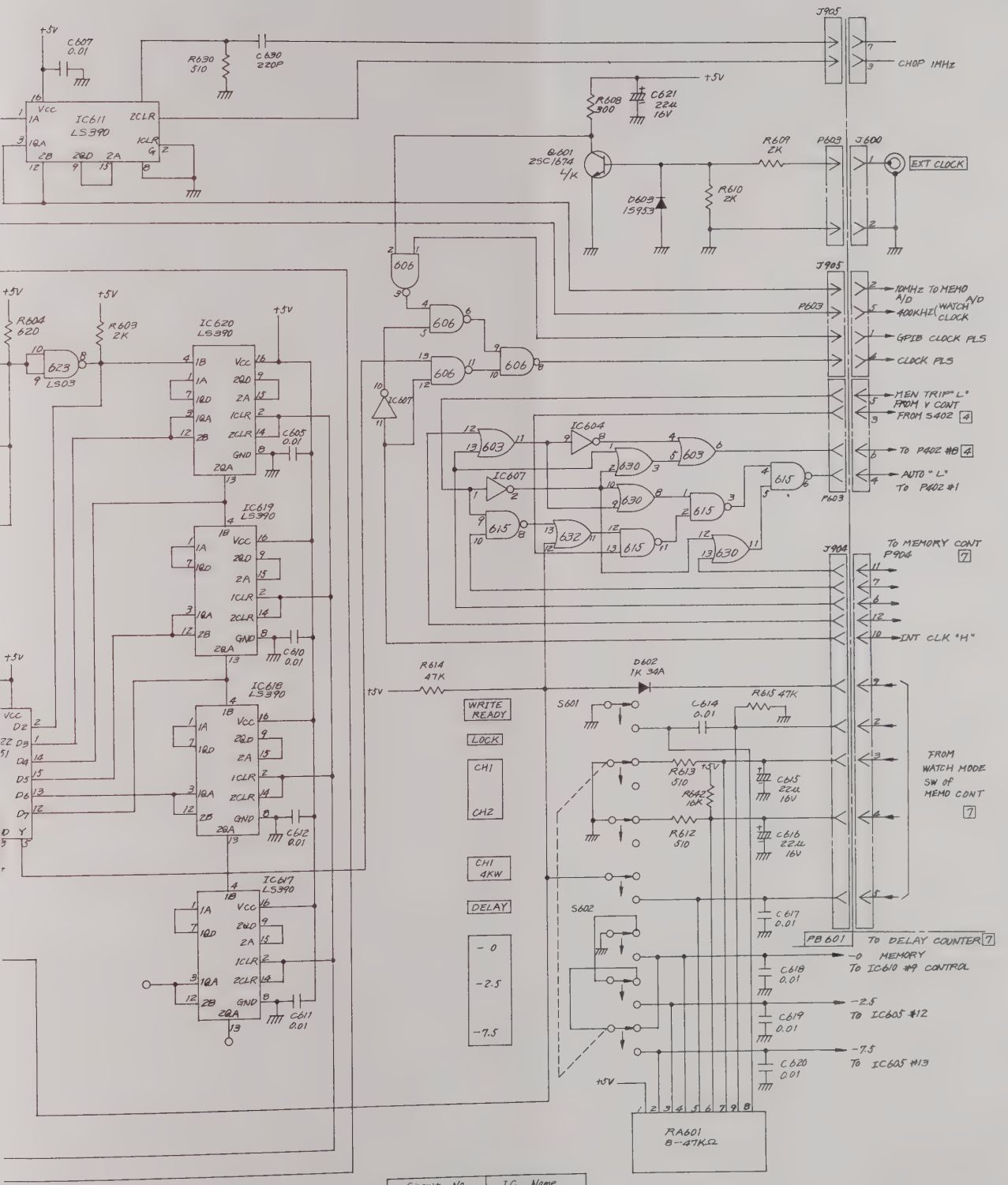
SS – 5802
TRIGGER & SWEEP GENERATORS 4

G – 601502


FROM P203#1
FROM P203#2
V-AMP XY SIGNAL FROM P105 #14
V-AMP XY MEMO SIGNAL P105 #14
P105 #4
FROM CLOCK GEN #10
FROM P203#15 XY CON CLK GEN
P601
PB601
J503
P503
J501
Q511 2SC1815GR
R550 20K
C531 0.01
D520 1S953
D503 1S953
D504 1S953
D501 1S953
R502 3.6K
R501 10
-12V
+12V
RL501
D530 1S953
FROM Q414 BASE
C504 0.033 HOLD OFF
C503 0.01
SWEEP OUT Q417 COLLECTER
R503 43K
C501 22μ/25V
RL502
D502 1S953
C502 0.01
C532 0.01
TIME/DIV
R528 1.25M
R529 1.25M
R530 500K
A-F
B-R
X-Y PEN
S
mS
HS
C511 10μ 50V
C512 47μ 25V
C513 1μ 25V
C514 0.047
C515 6800
C506 10μ
C507 1μ
C508 0.01
C509 82P
C510 20P
R538
RL503
Q501 2SC181
R542 3K
VARIABLE
R541 10K
CALIB
R540 20K
R539 20K


FROM P203#1
FROM P203#2
V-AMP XY SIGNAL FROM P105 #14
V-AMP XY MEMO SIGNAL P105 #14
P105 #4
FROM CLOCK GEN #10
FROM P203#15 XY CON
CLK GEN
P601
PB601
J503
P503
J501
SWEEP OUT
Q 417 COLLECTER
Q511 2SC1815GR
R550 20K
C531 0.01
D520 1S953
D503 1S953
D504 1S953
D501 1S953
R502 3.6K
R501 10
-12V
C501 224/25V
R503 43K
D502 1S953
C532 0.01
+12V
RL501
D530 1S955
FROM Q414 BASE
C504 0.033 HOLD OFF
C503 0.01
RL502
C502 2.01
TIME/DIV
R528 1.25M
R529 1.25M
R530 500K
A-F
B-R
B-F
X-Y PEN
S
mS
HS
C511 10μ 50V
C512 47μ 25V
C513 1μ 25V
C514 0.047
C515 6800
C506 10μ
C507 1μ
C508 0.01
C509 82P
C510 20P
R538
RL503
R542 3K
VARIABLE
R541 10K
CALIB
R540 20K
R539 20K
Q501 2SC181

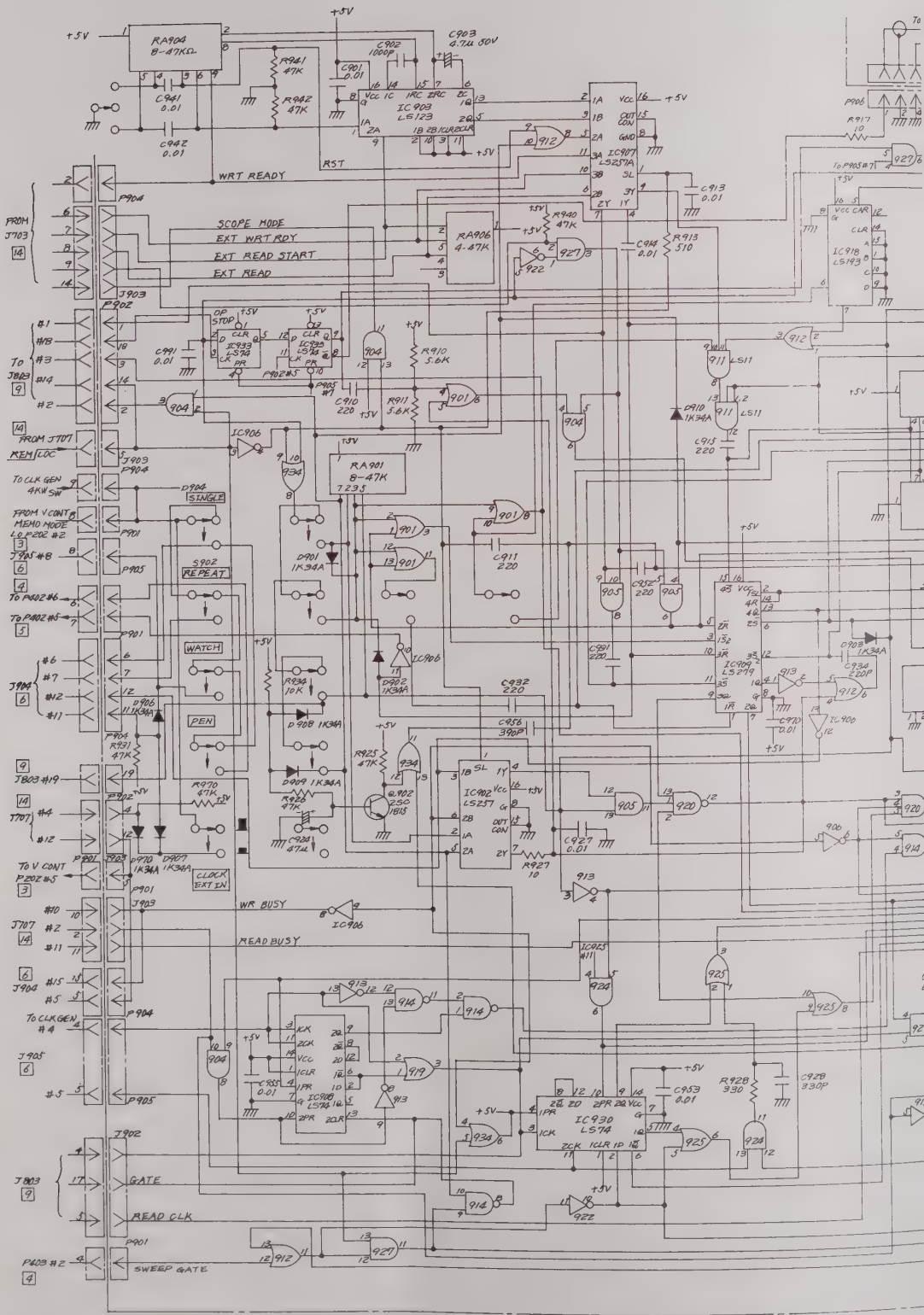

J904
R605 1K
WRITE BUSY
D601 TLR104
+5V
J905
C609 22u 16V
X601 20MHZ
C602 47P
R601 1.5K
C601 330
R602 1K
C603 330
C604 0.01
602
500
C606 0.01
IC612 LS390
Vcc GND
1A 1B 2B 2A
1CLR 2CLR
J602
FROM MEMORY 8
X5 1 X2 10S 0.1S 10m 1m 0.1
TC1 TC2 TC3 TC4 TC5 TC6 TC7 TC8
IC621
605
624
623 LS03
J905
FROM H PB 5
G X5 X1 X2 10S 0.1S 10mS 1mS 0.1mS
TS1 TS2 TS3 TS4 TS5 TS6 TS7 TS8
P601
RA602 6-47kΩ
IC616 LS151
STR
626 LS11
C613 0.01
IC607
603
WATCH CONT
WATCH Hi
FROM P905 #6 7
J905
FROM P904 #1 7
FROM P904 #13 7
FROM P904 #14 7
C640 0.01
0.1m3" H"
J904
IC604
632

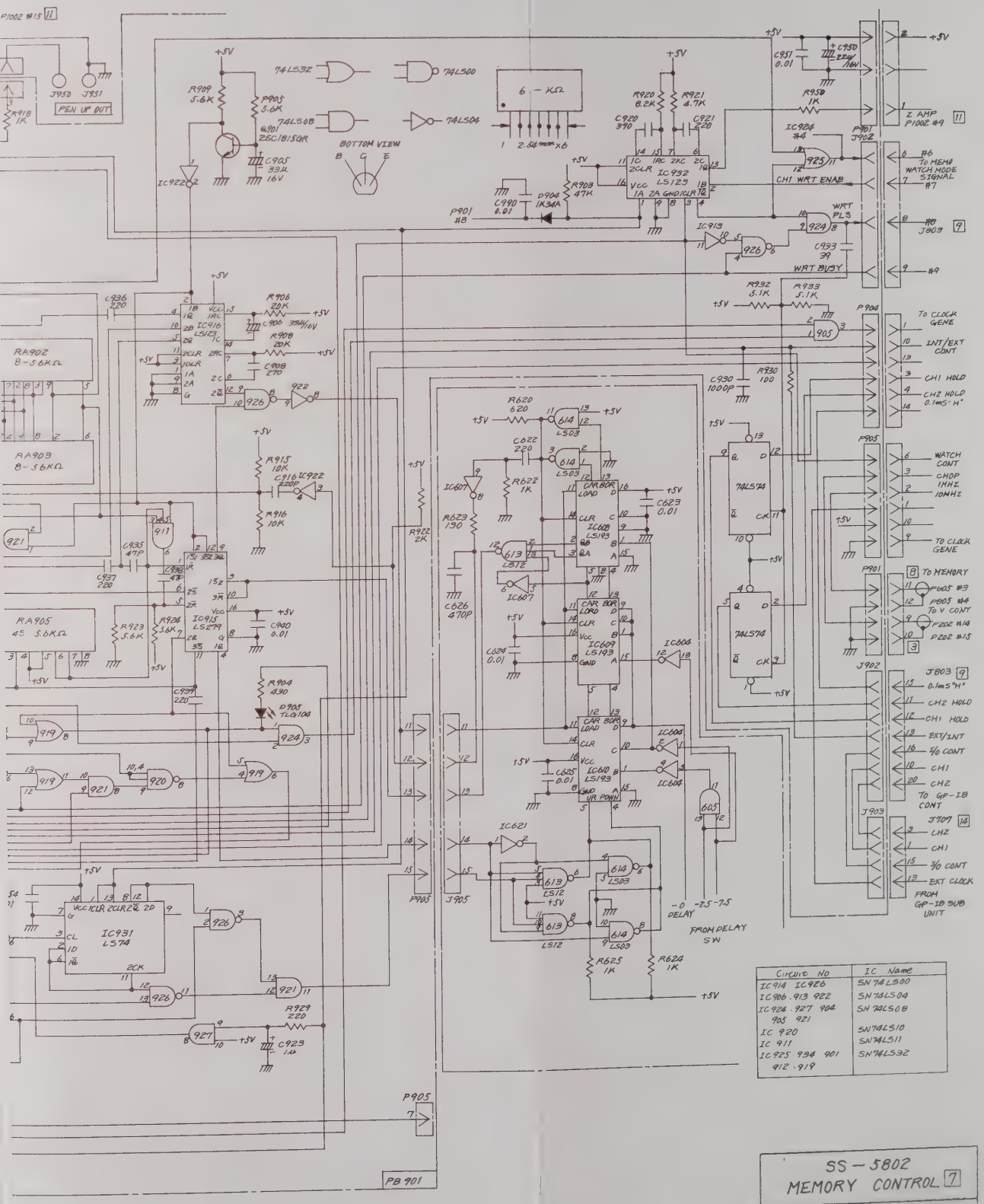


Circuit No	IC Name
IC 602	SN74LS00
IC 606 IC624	SN74LS06
IC 615	
IC 616 , IC623	SN74LS03
IC 604, 607, 621	SN74LS04
IC 605	SN74LS08
IC 626	SN74LS11
IC 619	SN74LS12
IC 603, 630, 632	SN74LS32

SS-5802
CLOCK GENERATOR 6

G-601503

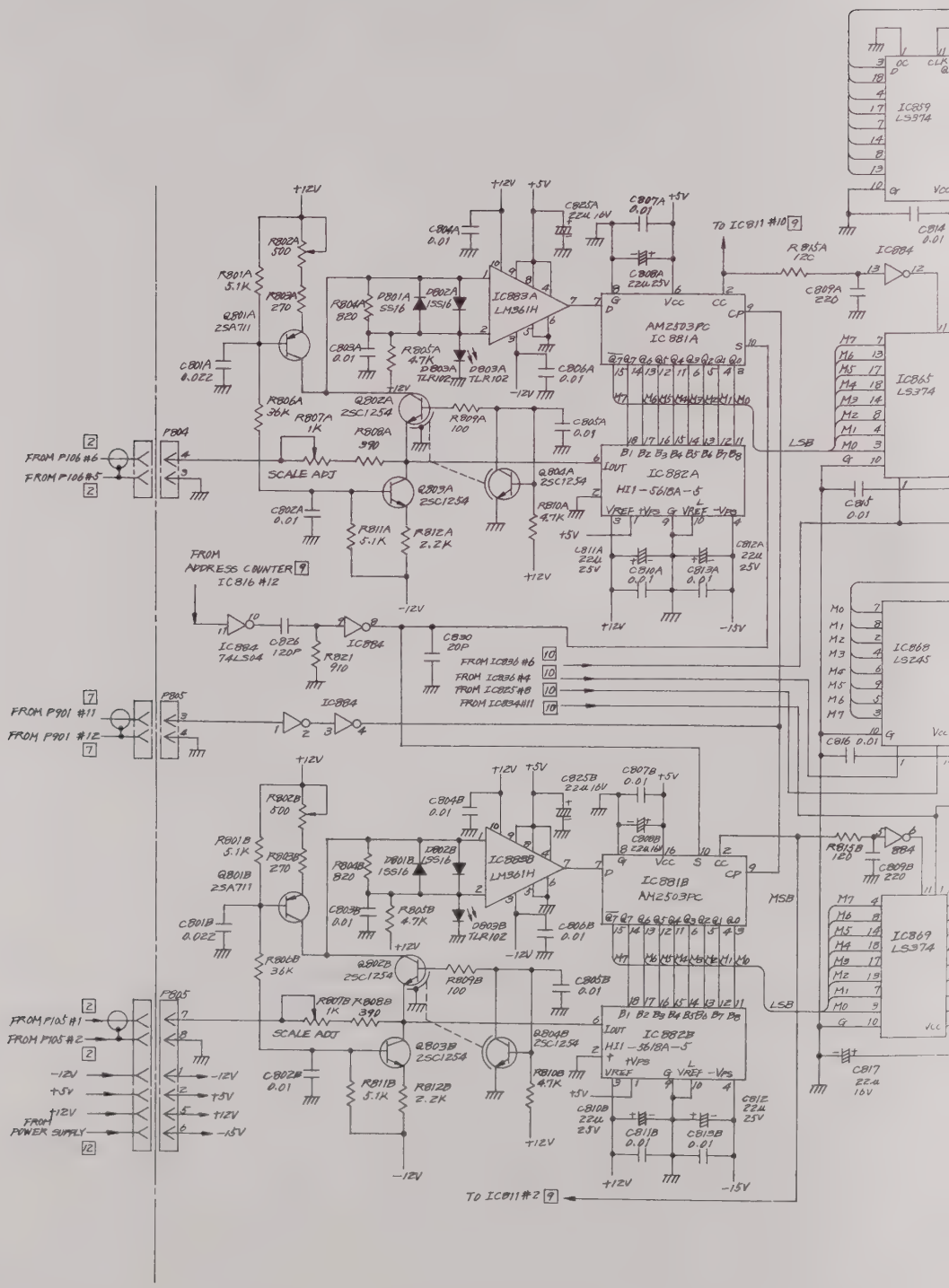

RA904 8-47KΩ
C941 0.01
C942 0.01
R941 47K
R942 47K
C901 0.01
C902 1000P
C903 4.7μ 50V
IC 903 LS123
WRT READY
RST
SCOPE MODE
EXT WRT RDY
EXT READ START
EXT READ
RA906 4-47K
R940 47K
C914 0.01
R913 510
C913 0.01
IC907 LS251A
IC918 LS193
R910 5.6K
R911 5.6K
C910 220
C915 220
IC906
RA 901 8-47K 7235
D901 1K34A
C911 220
C932 220
C931 220
IC904 LS279
D903 1K34A
C934 220P
C933 0.01
C930 0.01
D904 SINGLE
S902 REPEAT
WATCH
PEN
CLOCK EXT IN
D905 1K34A
D906 1K34A
D907 1K34A
D908 1K34A
D909 1K34A
R934 10K
R931 47K
R970 47K
R925 47K
R926 47K
C928 47μ
Q.902 2SD 1815
IC902 LS257
C927 0.01
R927 10
C856 390P
WR BUSY
READ BUSY
IC906
IC908 LS74
IC909 LS74
IC930 LS74
C953 0.01
R928 330
C928 330P
GATE
READ CLK
SWEEP GATE
FROM J703
REM LOC
TO CLK GEN 4KW SW
FROM V CONT MEMO MODE LOP202 #2
TO P902 #6
TO P902 #5
TO V CONT P202 #5
TO CLK GEN #4
P902
P903
P904
P905
P906
P907
J902
J903
J904
J905
J906
J907
J703
J803

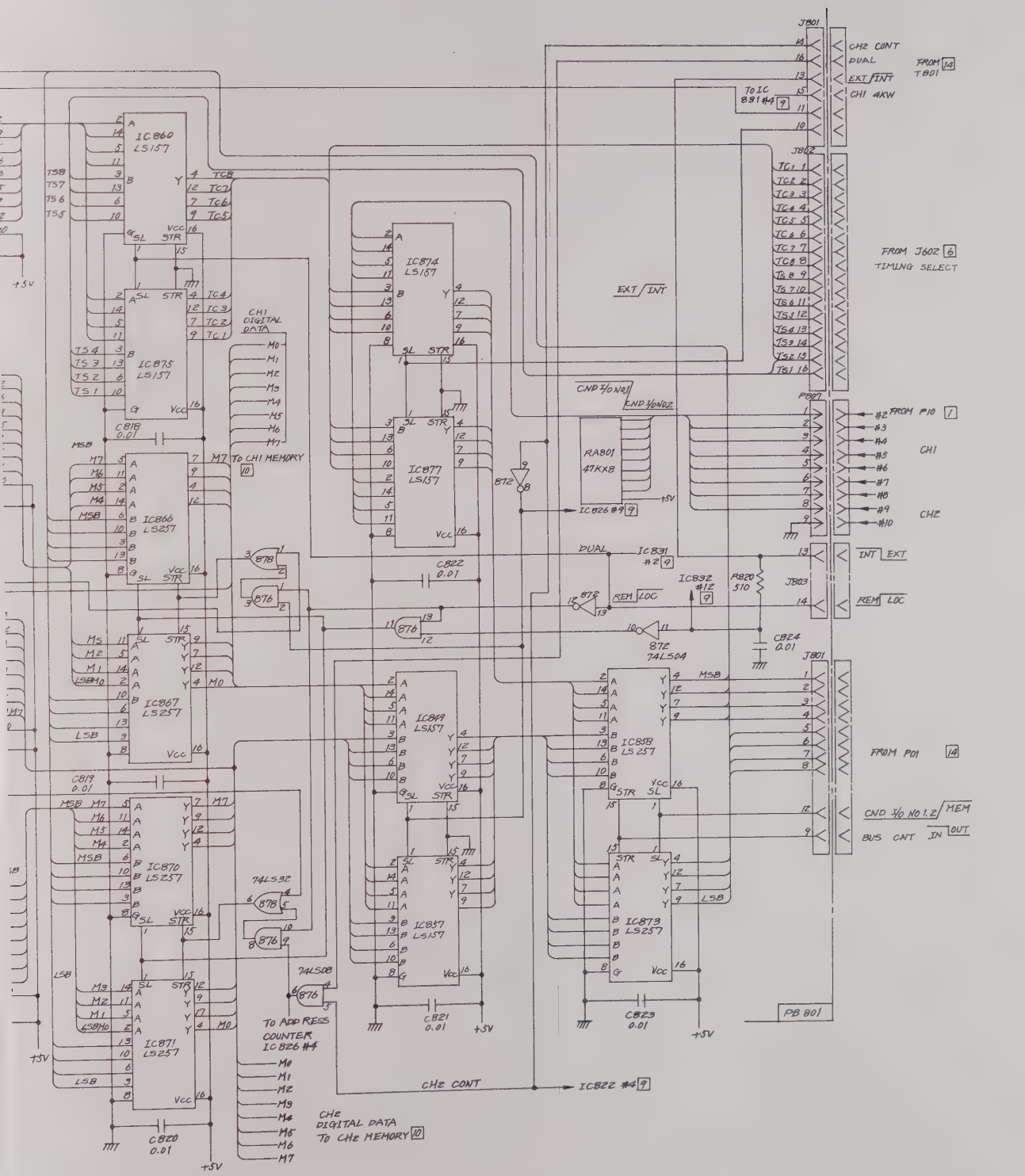


Circuit No	IC Name
IC 914 IC 926	SN 74LS00
IC 906 . 913 922	SN 74LS04
IC 924 . 927 904 905 921	SN 74LS08
IC 920	SN 74LS10
IC 911	SN 74LS11
IC 925 934 901 912 . 919	SN 74LS32

SS - 5802
MEMORY CONTROL 7

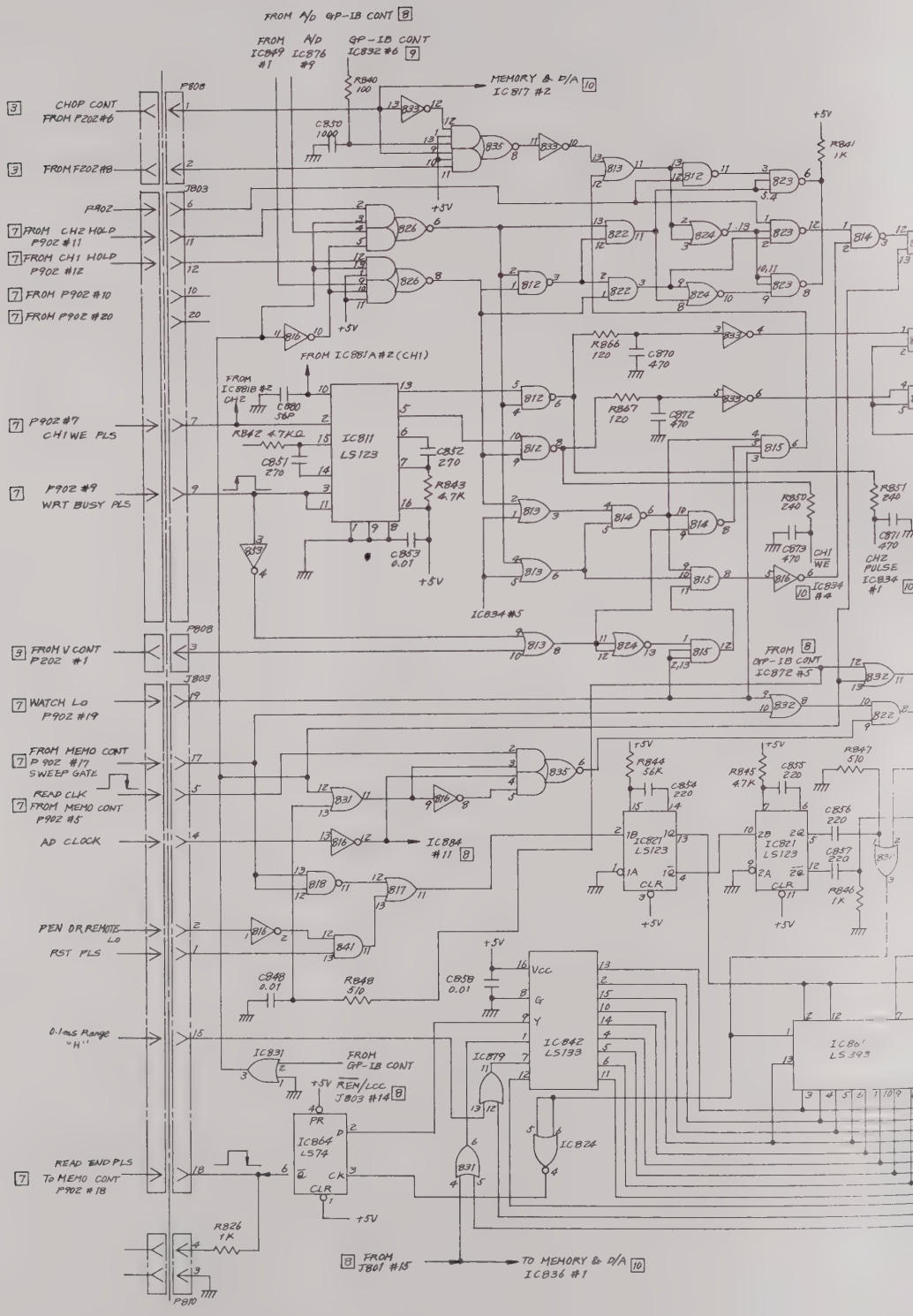
G - 601504

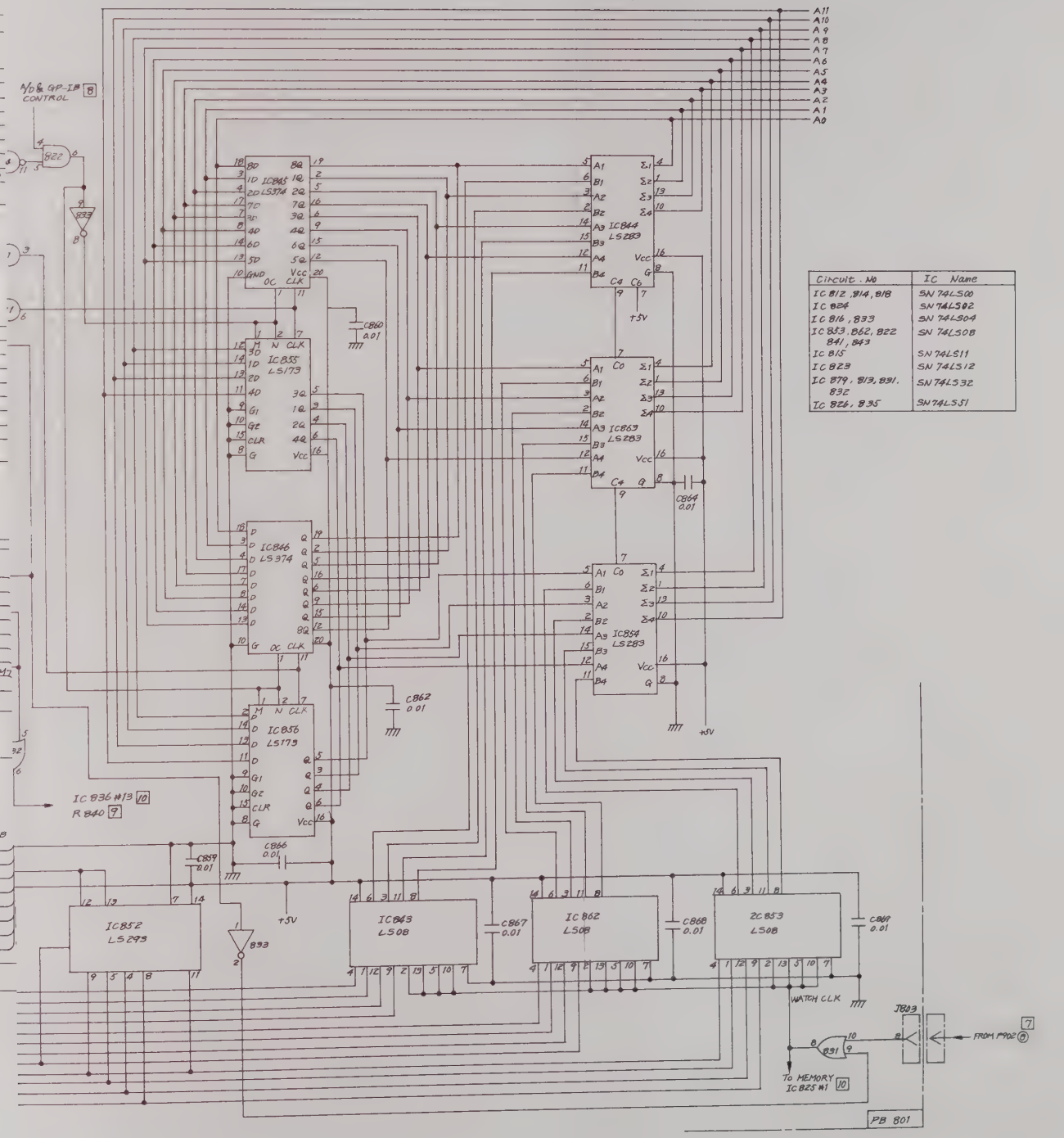

+12V
+5V
-12V
-15V
SCALE ADJ
FROM ADDRESS COUNTER 9
IC816 #12
LSB
MSB
TO IC811 #10 9
TO IC811 #2 9
FROM P106 #6
FROM P106 #5
FROM P901 #11
FROM P901 #12
FROM P105 #1
FROM P105 #2
FROM POWER SUPPLY
AM2503PC
IC881A
IC881B
IC882A
IC882B
HI1-5618A-5
LM361H
74LS04
LS374
LS245
SCALE ADJ



SS – 5802
A/D & GP-IB CONTROL 8

G – 601505

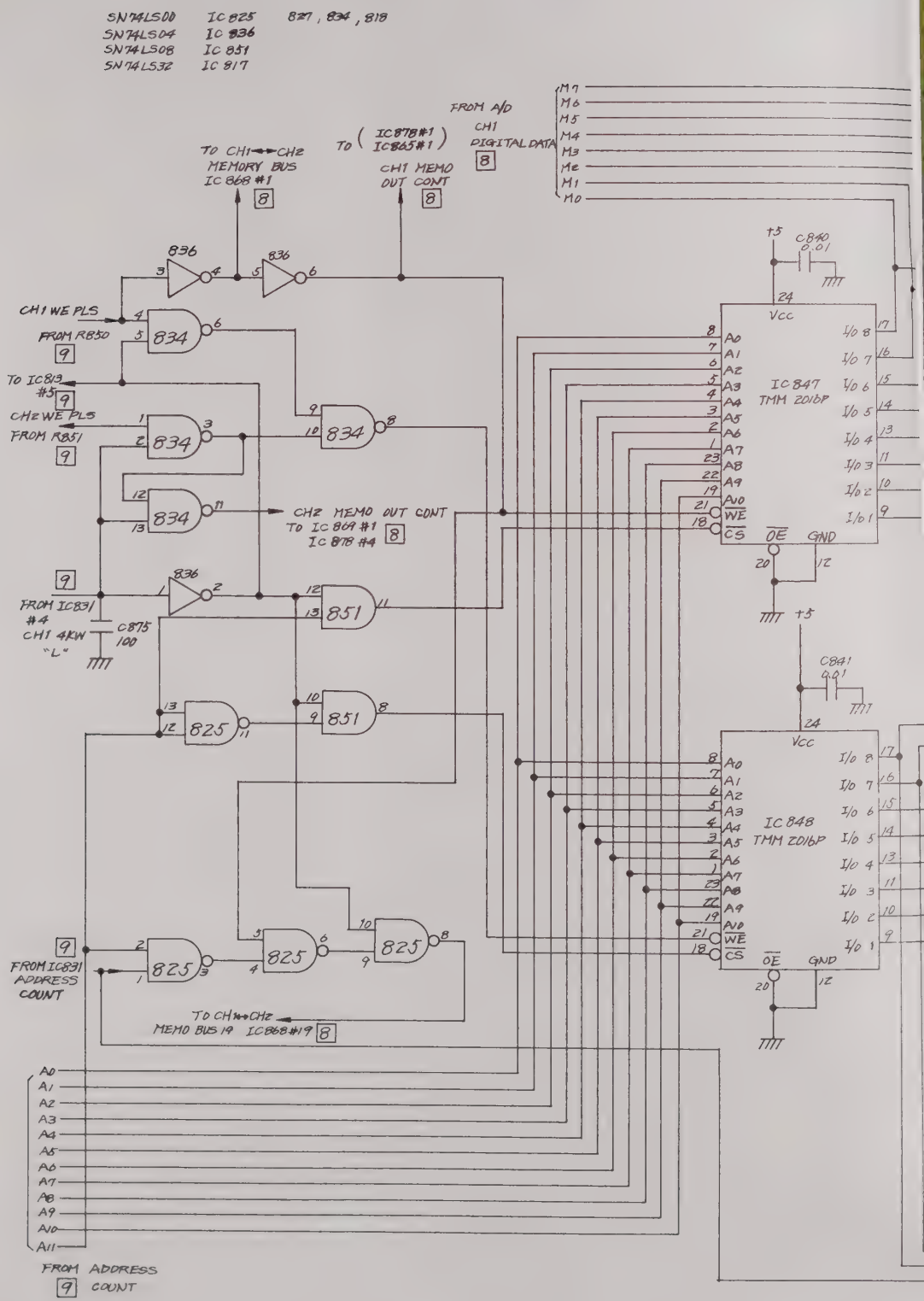

FROM A/D GP-IB CONT 8
FROM IC849 #1
A/D IC876 #9
GP-IB CONT IC832 #6 9
MEMORY & D/A IC817 #2 10
CHOP CONT FROM P202 #6
FROM P202 #8
P902
FROM CH2 HOLD P902 #11
FROM CH1 HOLD P902 #12
FROM P902 #10
FROM P902 #20
P902 #7 CH1 WE PLS
P902 #9 WRT BUSY PLS
FROM V CONT P202 #1
WATCH LO P902 #19
FROM MEMO CONT P 902 #17 SWEEP GATE
READ CLK FROM MEMO CONT P902 #5
AD CLOCK
PEN DR REMOTE LO
RST PLS
0.1ms Range "H"
READ END PLS To MEMO CONT P902 #18
FROM IC881A #2 (CH1)
FROM IC881B #2 CH2
IC811 LS123
IC884 #11 8
IC834 #5
IC834 #4
CH1 WE
CH2 PULSE IC834 #1 10
FROM 8 GP-IB CONT IC872 #5
IC831
FROM GP-IB CONT
REM/LCC J803 #14 8
IC864 LS74
IC879
IC842 LS133
IC824
IC861 LS393
8 FROM J801 #15
TO MEMORY & D/A ICB36 #1 10
P808
P810
J803
+5V
RB40 100
RB41 1K
C850 1000
RB66 120
C870 470
RB67 120
C872 470
RB50 240
RB51 240
C873 470
C871 470
RB42 4.7KΩ
C851 270
C852 270
RB43 4.7K
C853 0.01
RB44 56K
C854 220
RB45 47K
C855 220
RB47 510
C856 220
C857 220
RB46 1K
C848 0.01
RB48 510
C858 0.01
RB26 1K

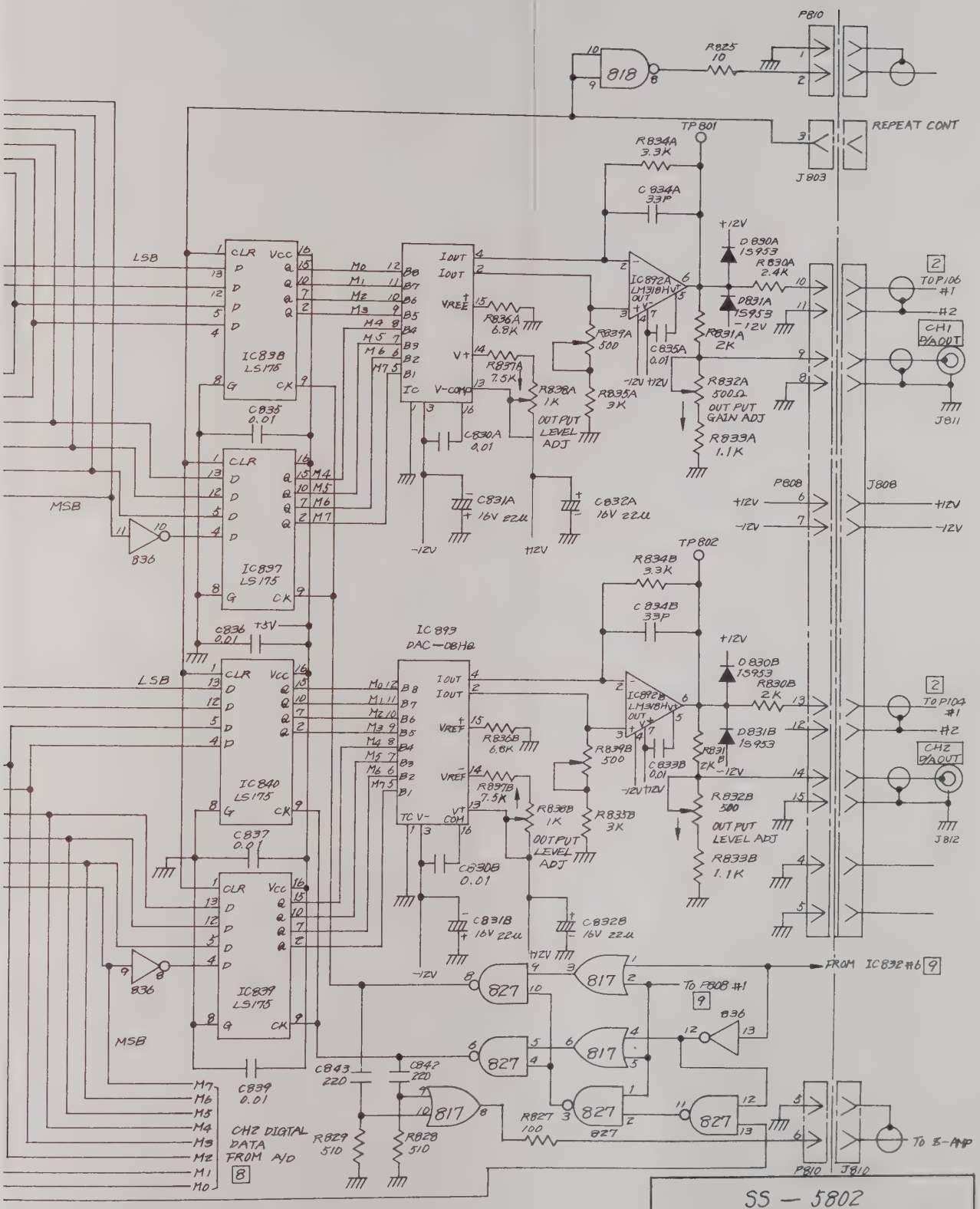


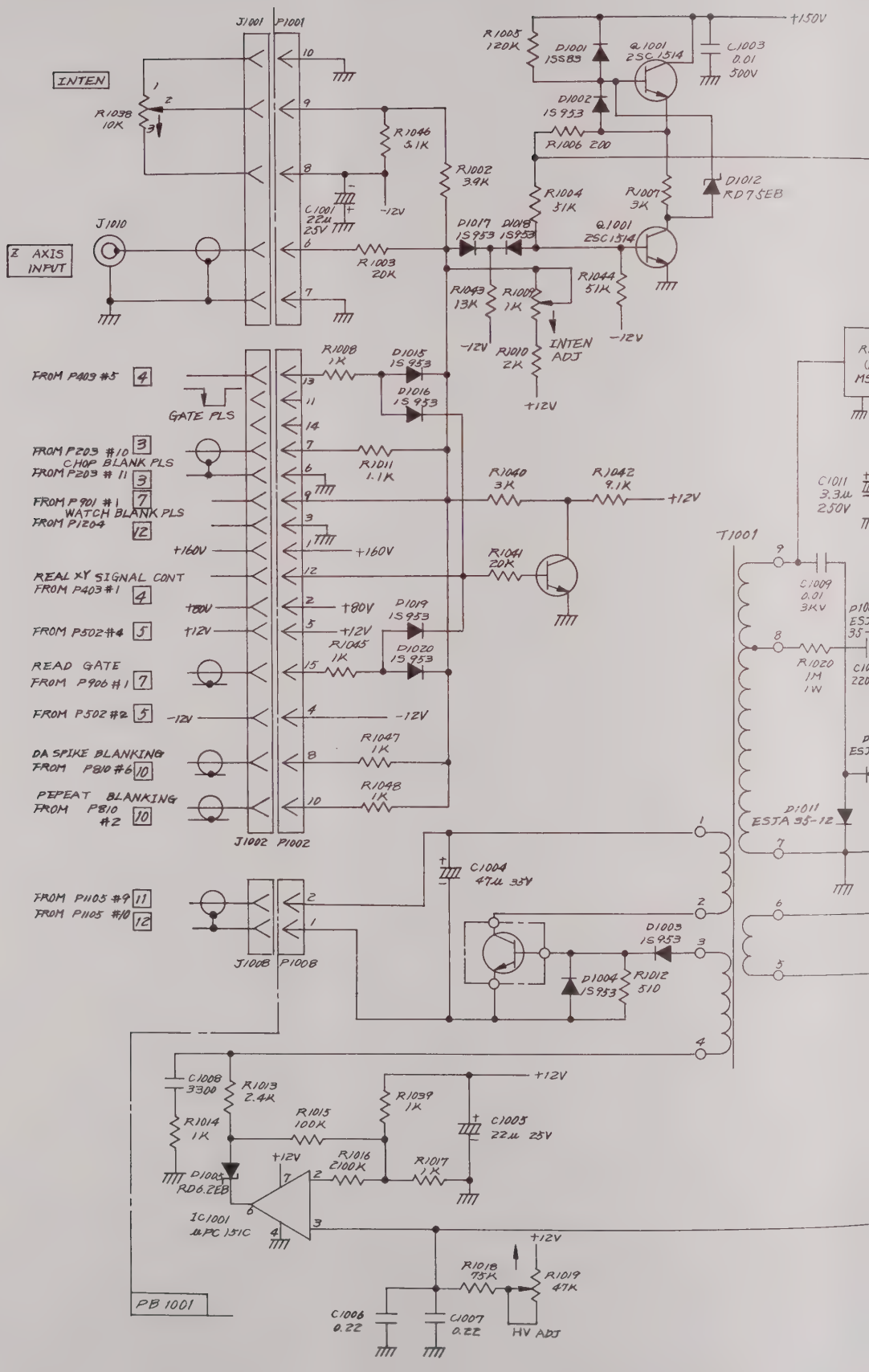
Circuit No	IC Name
IC 812, 814, 818	SN 74LS00
IC 824	SN 74LS02
IC 816, 833	SN 74LS04
IC 813, 862, 822 841, 843	SN 74LS08
IC 815	SN 74LS11
IC 823	SN 74LS12
IC 879, 813, 831, 832	SN 74LS32
Ic 826, 835	SN 74LS51

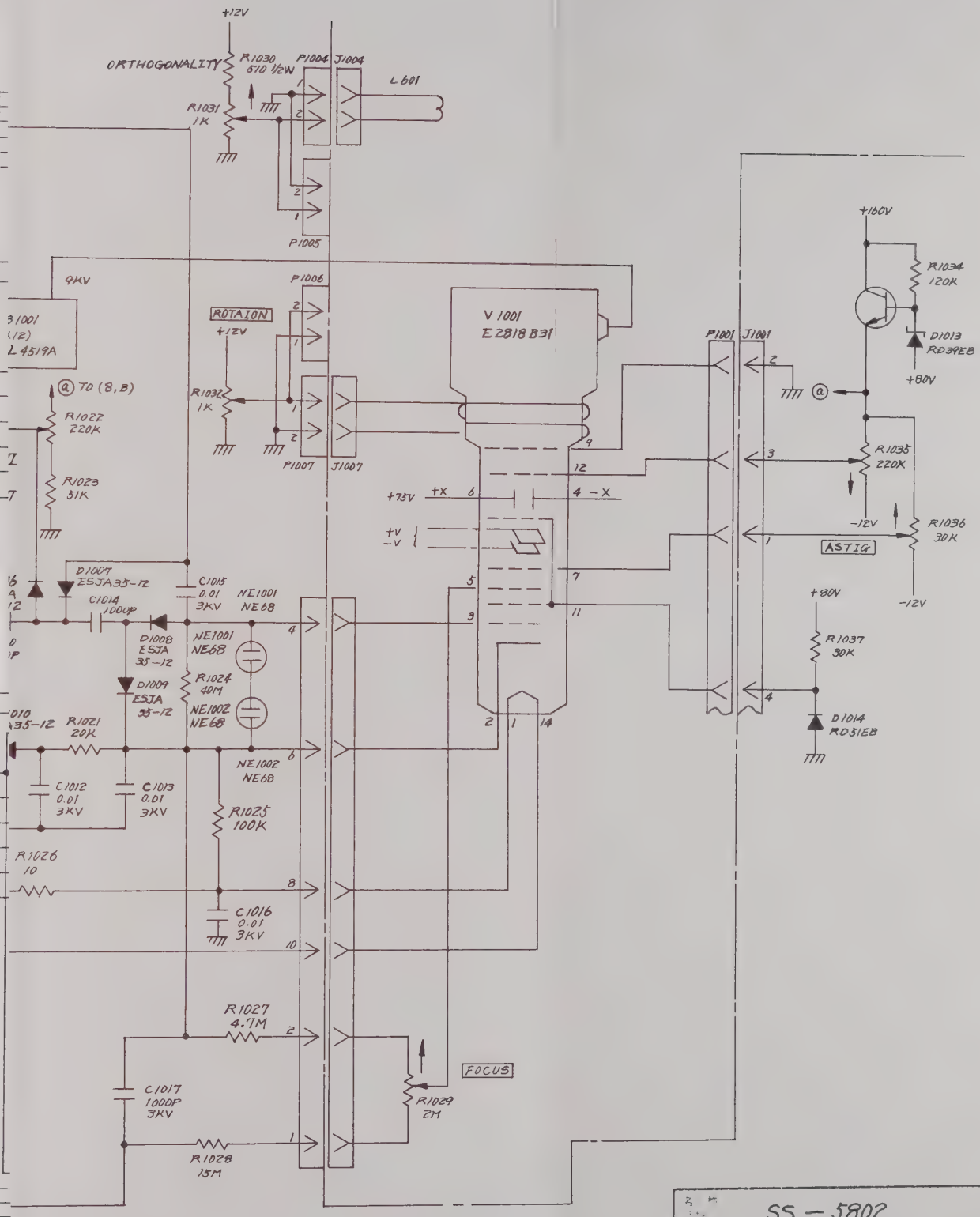
SS – 5802
ADDRESS COUNTER 9

G – 601506


SN74LS00 IC 825 827, 834, 818
SN74LS04 IC 836
SN74LS08 IC 851
SN74LS32 IC 817
FROM A/D CH1 DIGITAL DATA
M7 M6 M5 M4 M3 M2 M1 M0
TO CH1↔CH2 MEMORY BUS IC 868 #1
TO (IC 878 #1 IC 885 #1)
CH1 MEMO OUT CONT
836
834
851
825
CH1 WE PLS
FROM RB50
TO IC 813 #5
CH2 WE PLS
FROM RB51
CH2 MEMO OUT CONT
TO IC 869 #1 IC 878 #4
FROM IC831 #4 CH1 4KW "L"
C875 100
C840 0.01
C841 0.01
IC 847 TMM 2016P
IC 848 TMM 2016P
Vcc
GND
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11
I/O 8 I/O 7 I/O 6 I/O 5 I/O 4 I/O 3 I/O 2 I/O 1
WE CS OE
FROM IC831 ADDRESS COUNT
TO CH1↔CH2 MEMO BUS 19 IC 868 #19
FROM ADDRESS COUNT

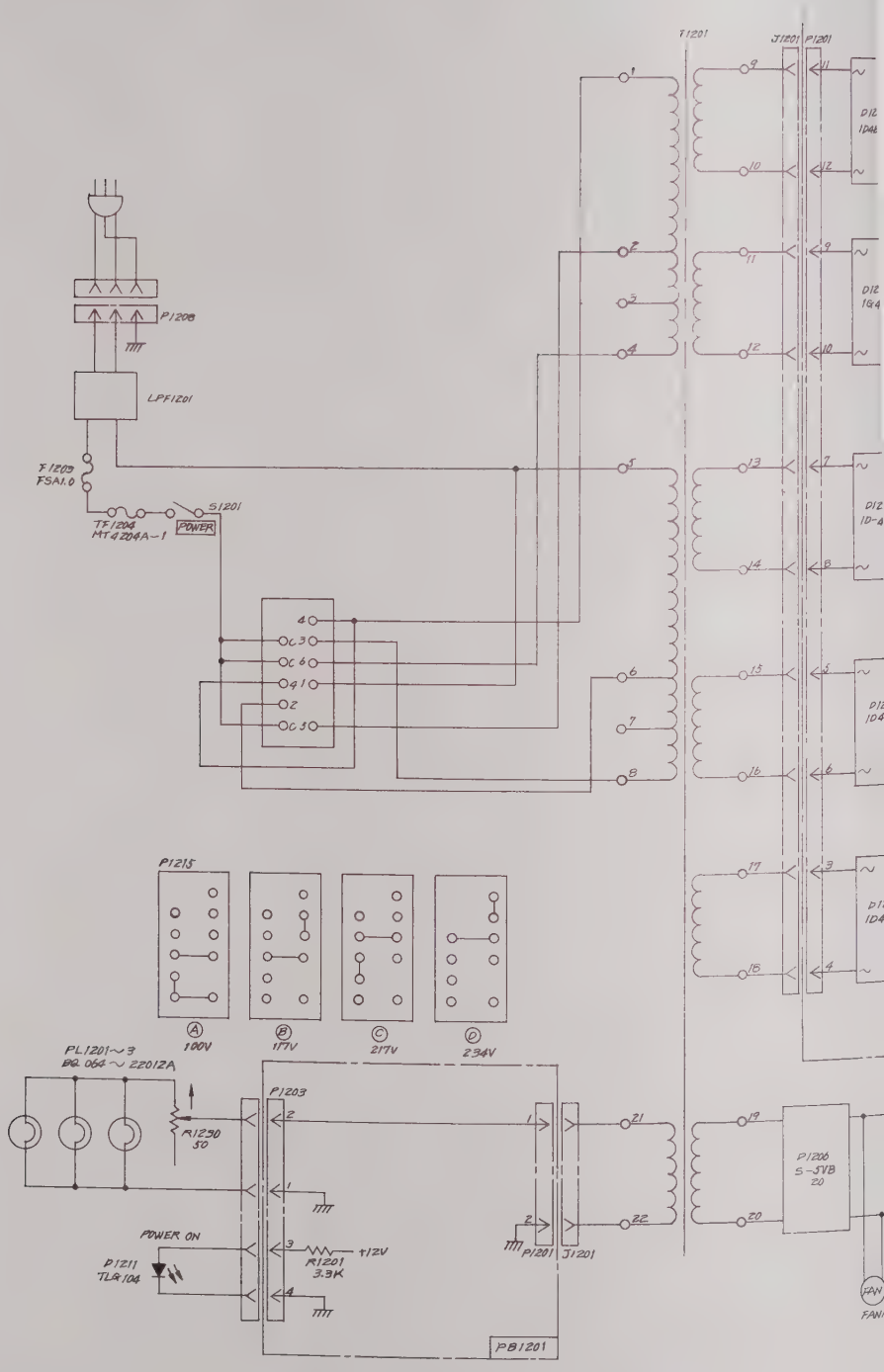

P810
818
R825 10
REPEAT CONT
J803
TP801
R834A 3.3K
C834A 33P
+12V
D830A 1S953
R830A 2.4K
IC892A LM318HV
D831A 1S953
-12V
R831A 2K
C835A 0.01
R832A 500Ω OUT PUT GAIN ADJ
R833A 1.1K
TOP106 #1
#2
CH1 D/A OUT
J811
LSB
IC838 LS175
C835 0.01
MSB
836
IC897 LS175
C836 0.01
+5V
IC893 DAC-08HQ
R836A 6.8K
R837A 7.5K
R838A 1K
R839A 500
R835A 3K
OUTPUT LEVEL ADJ
C830A 0.01
C831A 16V 22u
C832A 16V 22u
P808
J808
+12V
-12V
TP802
R834B 3.3K
C834B 33P
D830B 1S953
R830B 2K
IC892B LM318HV
D831B 1S953
R831B 2K
R839B 500
C833B 0.01
R832B 500
OUT PUT LEVEL ADJ
R833B 1.1K
TOP104 #1
#2
CH2 D/A OUT
J812
R836B 6.8K
R837B 7.5K
R838B 1K
R835B 3K
OUTPUT LEVEL ADJ
C830B 0.01
C831B 16V 22u
C832B 16V 22u
IC840 LS175
C837 0.01
IC839 LS175
C839 0.01
836
MSB
M7
M6
M5
M4
M3
M2
M1
M0
CH2 DIGITAL DATA FROM A/D
8
827
817
FROM IC832 #6
9
To P808 #1
C843 220
C842 220
R829 510
R828 510
R827 100
To B-AMP
P810
J810
PB801
SS - 5802
MEMORY & D/A
10
K-607274

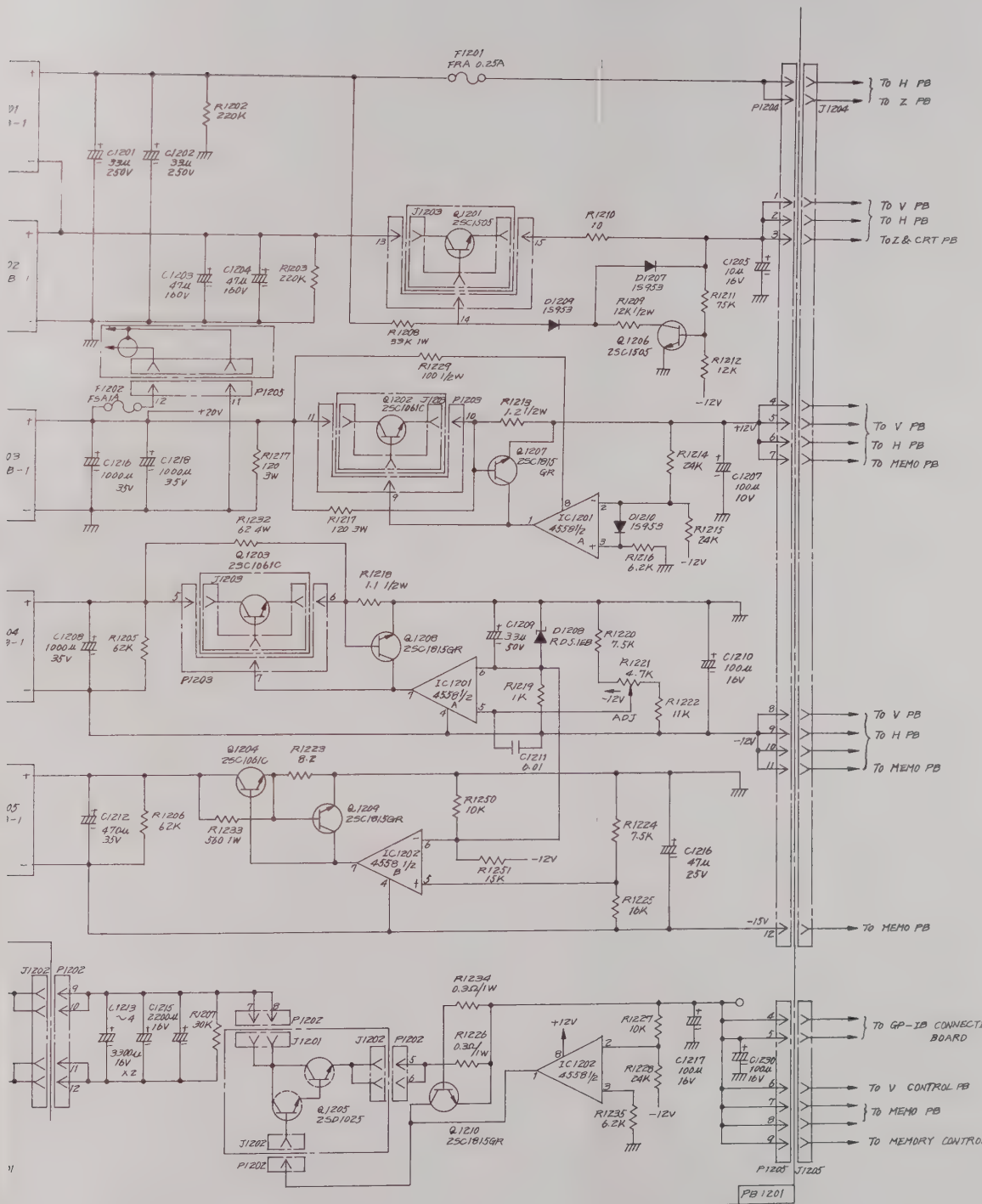

J1001
P1001
INTEN
R1038 10K
R1046 5.1K
R1002 3.9K
C1001 22u 25V
-12V
J1010
Z AXIS INPUT
R1003 20K
R1005 120K
D1001 1S885
Q1001 2SC1514
C1003 0.01 500V
+150V
D1002 1S953
R1006 200
R1004 51K
R1007 3K
D1012 RD7.5EB
D1017 1S953
D1018 1S953
Q1001 2SC1514
R1043 13K
R1009 1K
R1044 51K
INTEN ADJ
R1010 2K
+12V
FROM P403 #5 4
GATE PLS
FROM P203 #10 3
CHOP BLANK PLS
FROM P203 # 11 3
FROM P901 #1 7
WATCH BLANK PLS
FROM P1204 12
+160V
REAL XY SIGNAL CONT
FROM P403 #1 4
+80V
FROM P502 #4 5
+12V
READ GATE
FROM P906 #1 7
FROM P502 #2 5
-12V
DA SPIKE BLANKING
FROM P810 #6 10
REPEAT BLANKING
FROM P810 #2 10
R1008 1K
D1015 1S953
D1016 1S953
R1011 1.1K
R1040 3K
R1042 9.1K
R1041 20K
D1019 1S953
R1045 1K
D1020 1S953
R1047 1K
R1048 1K
J1002
P1002
T1001
C1009 0.01 3KV
R1020 1M 1W
D1011 ESJA 95-12
C1004 47u 35V
FROM P1105 #9 11
FROM P1105 #10 12
J1008
P1008
D1003 1S953
D1004 1S953
R1012 510
C1008 3300
R1013 2.4K
R1014 1K
R1015 100K
R1039 1K
C1005 22u 25V
D1005 RD6.2EB
R1016 2100K
R1017 1K
IC1001 μPC 151C
R1018 75K
R1019 47K
HV ADJ
C1006 0.22
C1007 0.22
PB 1001



SS-5802
Z & CRT CIRCUIT 11

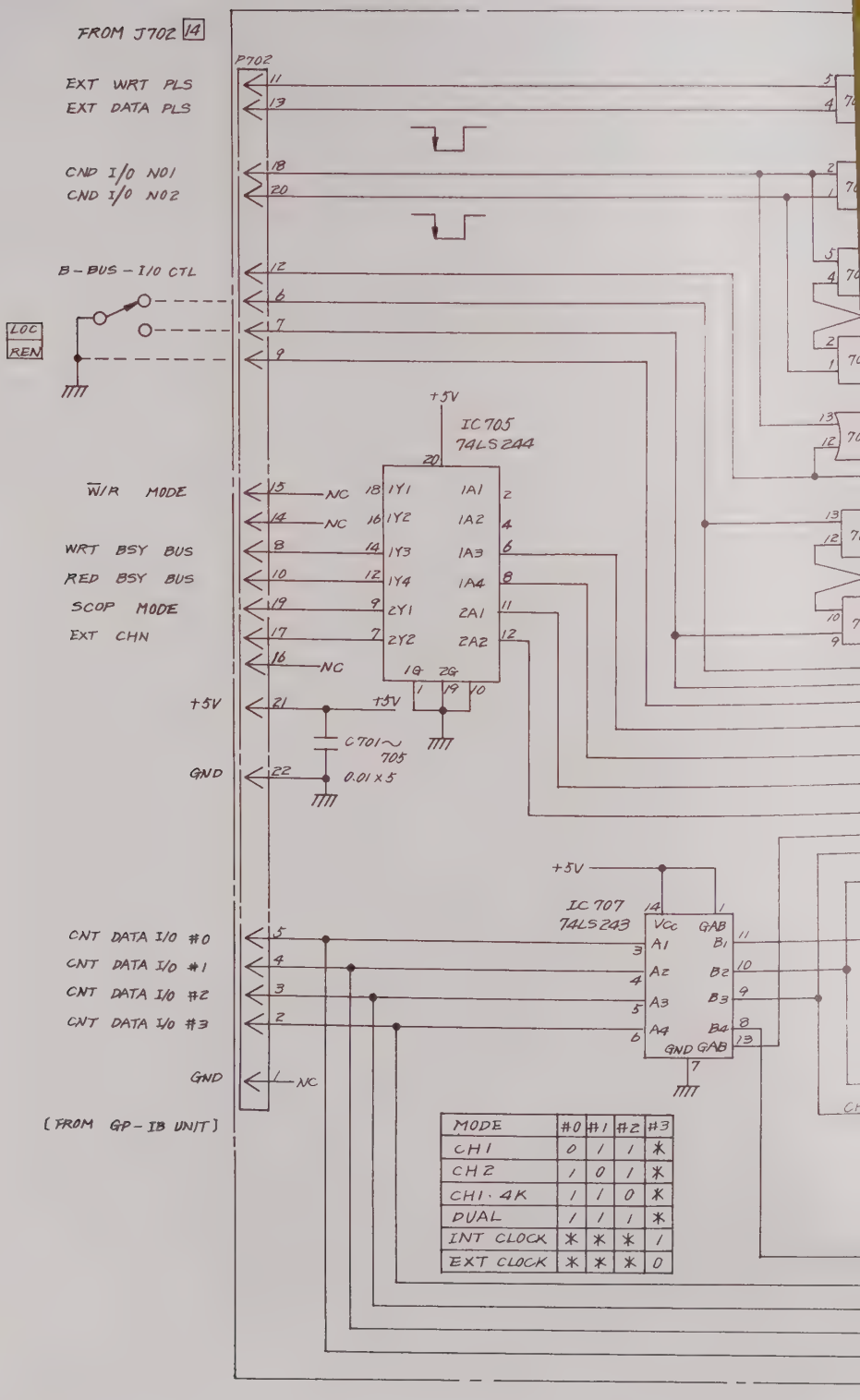
K-607275

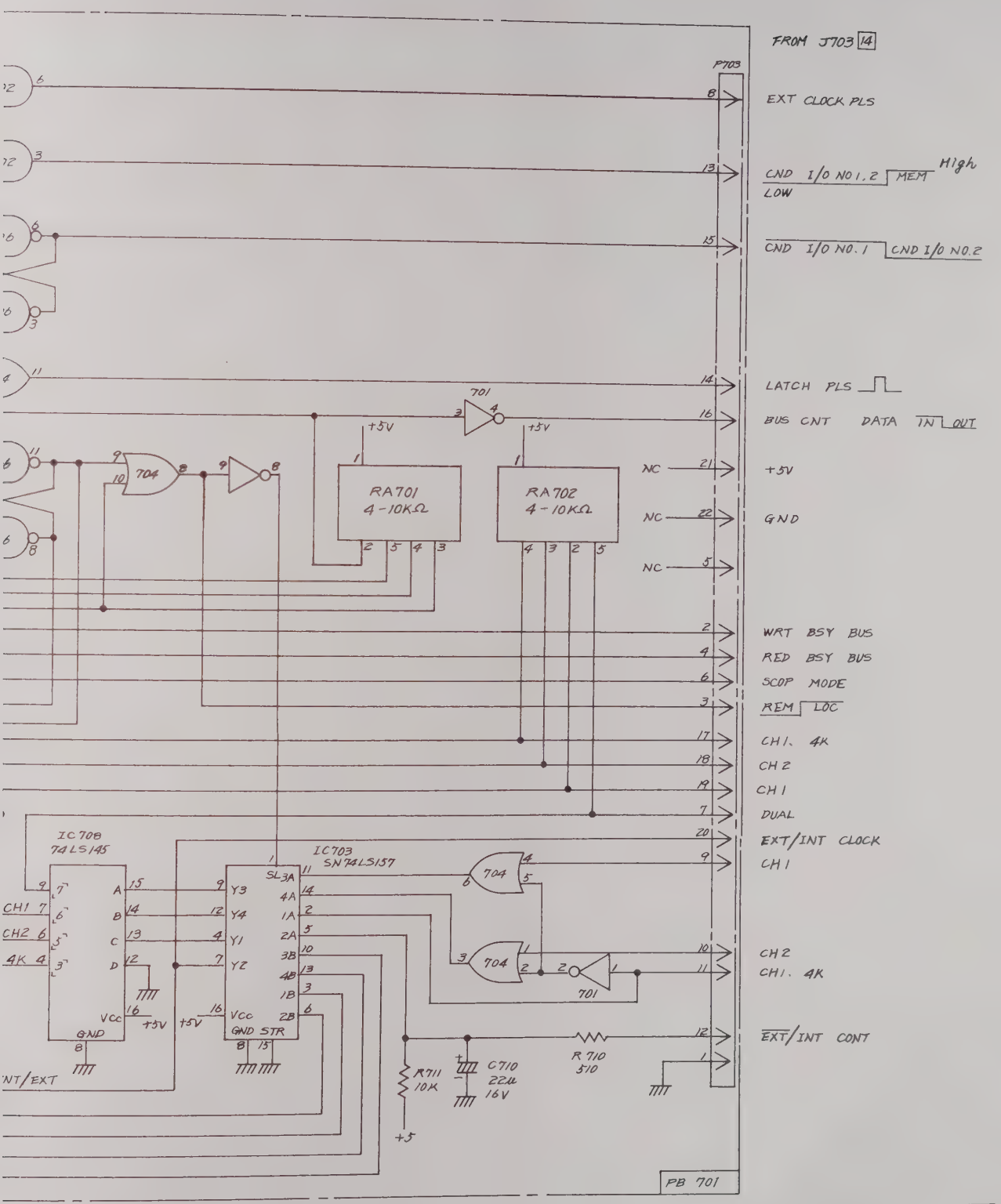

T1201
J1201
P1201
P1208
LPF1201
F1203
FSA1.0
TF1204
MT4204A-1
S1201
POWER
P1215
A
100V
B
117V
C
217V
D
234V
PL1201~3
BQ 064~Z2012A
R1230
50
P1203
POWER ON
D1211
TLR104
R1201
3.31K
+12V
P1201
J1201
P1206
S-5VB
20
FAN
PB1201



SS — 5802
POWER SUPPLY 12

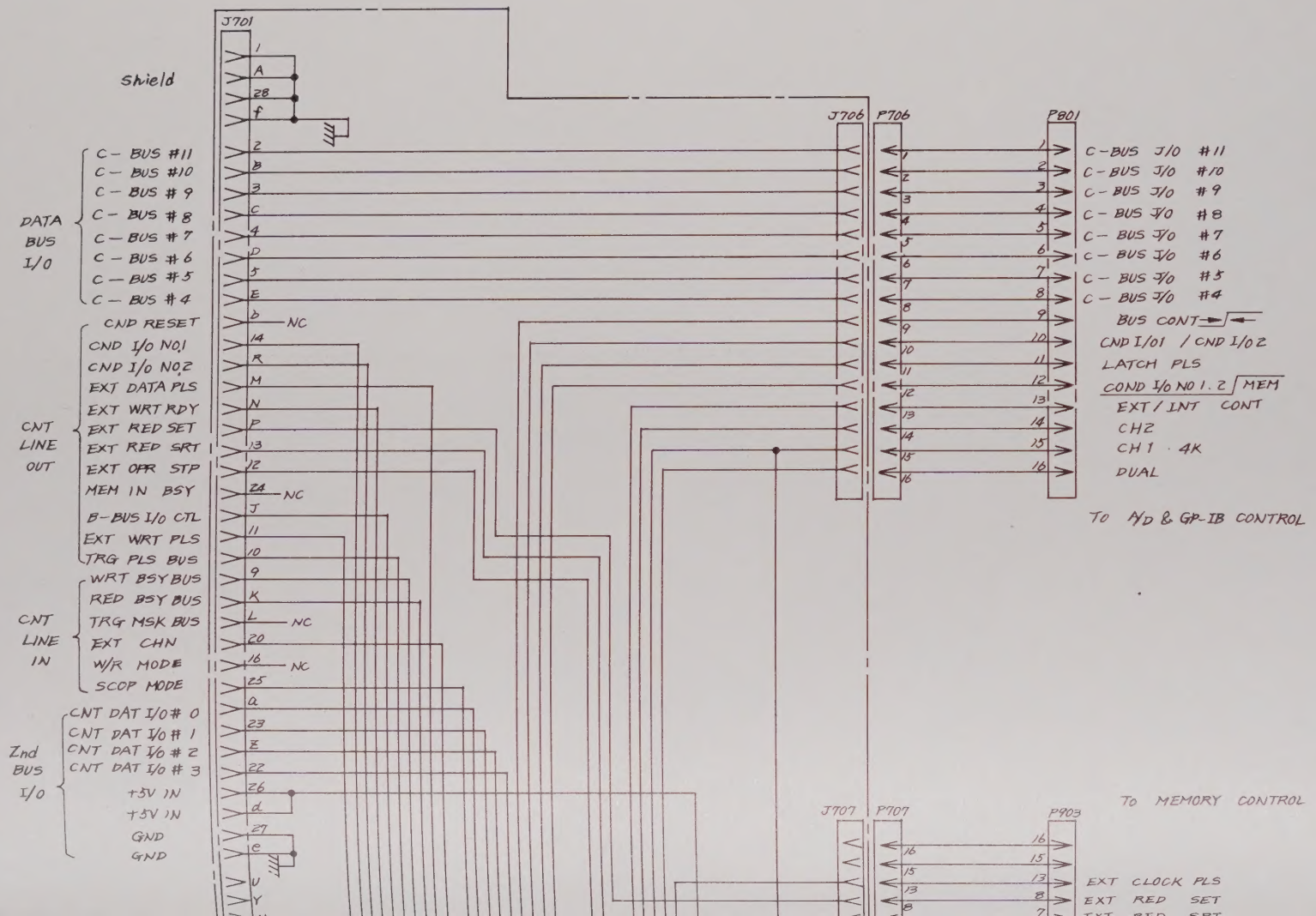
G — 601507

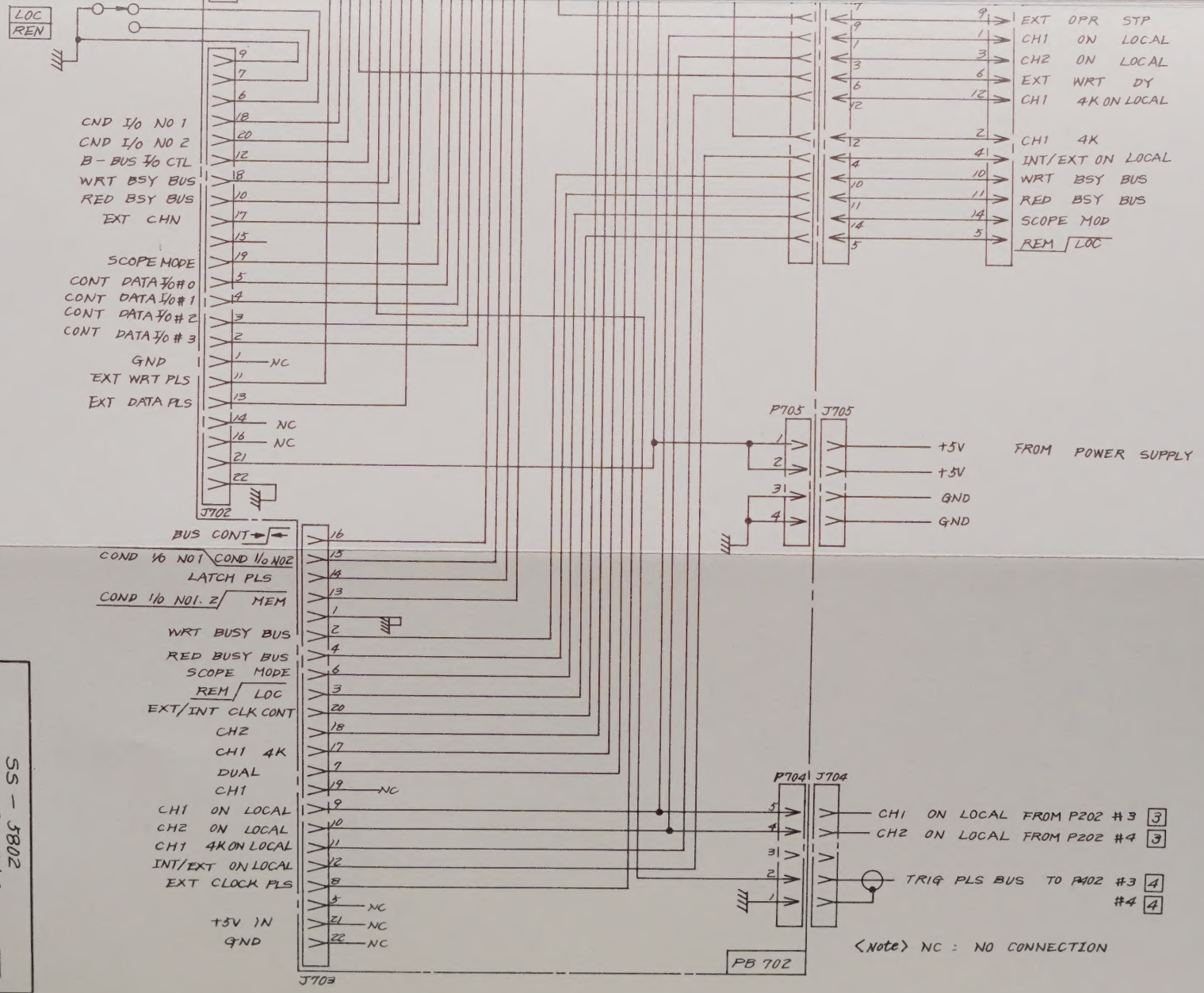

FROM J702 14
P702
EXT WRT PLS
EXT DATA PLS
CND I/O NO1
CND I/O NO2
B-BUS-I/O CTL
LOC
REN
IC 705
74LS244
W/R MODE
WRT BSY BUS
RED BSY BUS
SCOP MODE
EXT CHN
+5V
GND
C701~705
0.01×5
IC 707
74LS243
CNT DATA I/O #0
CNT DATA I/O #1
CNT DATA I/O #2
CNT DATA I/O #3
[FROM GP-IB UNIT]
MODE | #0 | #1 | #2 | #3
CH1 | 0 | 1 | 1 | *
CH2 | 1 | 0 | 1 | *
CH1·4K | 1 | 1 | 0 | *
DUAL | 1 | 1 | 1 | *
INT CLOCK | * | * | * | 1
EXT CLOCK | * | * | * | 0



SS-5802
GP-IB SUB UNIT 13

K-607276


J701
Shield
DATA BUS I/O
C - BUS #11
C - BUS #10
C - BUS #9
C - BUS #8
C - BUS #7
C - BUS #6
C - BUS #5
C - BUS #4
CNT LINE OUT
CND RESET
CND I/O NO.1
CND I/O NO.2
EXT DATA PLS
EXT WRT RDY
EXT RED SET
EXT RED SRT
EXT OPR STP
MEM IN BSY
B-BUS I/O CTL
EXT WRT PLS
TRG PLS BUS
CNT LINE IN
WRT BSY BUS
RED BSY BUS
TRG MSK BUS
EXT CHN
W/R MODE
SCOP MODE
2nd BUS I/O
CNT DAT I/O # 0
CNT DAT I/O # 1
CNT DAT I/O # 2
CNT DAT I/O # 3
+5V IN
+5V IN
GND
GND
NC
J706
P706
P801
C-BUS I/O #11
C-BUS I/O #10
C-BUS I/O #9
C-BUS I/O #8
C-BUS I/O #7
C-BUS I/O #6
C-BUS I/O #5
C-BUS I/O #4
BUS CONT
CND I/O1 / CND I/O2
LATCH PLS
COND I/O NO 1. 2 / MEM
EXT / INT CONT
CH2
CH1 . 4K
DUAL
To A/D & GP-IB CONTROL
To MEMORY CONTROL
J707
P707
P903
EXT CLOCK PLS
EXT RED SET


LOC
REN
CND I/O NO 1
CND I/O NO 2
B-BUS I/O CTL
WRT BSY BUS
RED BSY BUS
EXT CHN
SCOPE MODE
CONT DATA I/O # 0
CONT DATA I/O # 1
CONT DATA I/O # 2
CONT DATA I/O # 3
GND
EXT WRT PLS
EXT DATA PLS
NC
NC
NC
J702
EXT OPR STP
CH1 ON LOCAL
CH2 ON LOCAL
EXT WRT DY
CH1 4K ON LOCAL
CH1 4K
INT/EXT ON LOCAL
WRT BSY BUS
RED BSY BUS
SCOPE MOD
REM / LOC
P705
J705
+5V
+5V
GND
GND
FROM POWER SUPPLY
BUS CONT
COND I/O NO1 \ COND I/O NO2
LATCH PLS
COND I/O NO1. 2 / MEM
WRT BUSY BUS
RED BUSY BUS
SCOPE MODE
REM / LOC
EXT/INT CLK CONT
CH2
CH1 4K
DUAL
CH1
CH1 ON LOCAL
CH2 ON LOCAL
CH1 4K ON LOCAL
INT/EXT ON LOCAL
EXT CLOCK PLS
+5V IN
GND
NC
J703
P704
J704
CH1 ON LOCAL FROM P202 #3 3
CH2 ON LOCAL FROM P202 #4 3
TRIG PLS BUS TO P202 #3 4
#4 4
PB 702
<Note> NC : NO CONNECTION
SS-J802
GP-IB I/O
CONNECTION BOARD 14
K-607277

MP MASTER
MA31654

IWATSU ELECTRIC CO., LTD.